User Manual for the CR:800C Series of Sound Level Meters

Cirrus Research plc

dedicated to noise measurement

This manual, the software to which it relates, the program code and drawings are all:
© Copyright Cirrus Research plc 1989-2008

The content of this manual, any illustrations, technical information and descriptions within this document were correct at the time of going to print. Cirrus Research plc reserves the right to make any changes necessary, without notice, in line with the policy of continuing product development and improvement.

No part of this publication may be duplicated, reprinted, stored in a data processing system or transmitted by electronic, mechanical, photographic or other means, or recorded, translated, edited, abridged or expanded without the prior written consent of Cirrus Research plc.

No liability is accepted for any inaccuracies or omissions in this manual, although due care has been taken to ensure that is it complete and accurate as possible.

Accessories supplied by Cirrus Research plc have been designed for use with the instrumentation manufactured by Cirrus Research plc. No responsibility is accepted for damage caused by the use of any other parts or accessories.

In order to take account of a policy of continual development, Cirrus Research plc reserves the right to change any of the information contained in this publication without prior notice.

Produced by Cirrus Research plc, Acoustic House, Bridlington Road, Hunmanby, North Yorkshire, YO14 0PH, United Kingdom.

© Copyright Cirrus Research plc 2008

Reference Number 07/11/CR:800C/01

Document Printing Date Monday, 11 February 2008

1 Preface 5
1.1 Messages and Symbols 5
2 Introduction 6
2.1 Main Features 6
2.2 Measurement Functions 6
2.3 Broadband Measurement Mode 6
2.4 1:1 & 1:3 Octave Band Measurement Mode 7
2.5 Options & Accessories 7
3 Getting Started 8
3.1 How to... 8
3.2 Quick Start 9
3.3 Unpacking and checking the Sound Level Meter 13
3.4 Instruments Layout 14
3.5 Assembly 15
3.6 Switching On 17
3.7 Checking the Configuration of the Instrument 18
3.8 Calibration 21
3.9 Starting a measurement 22
3.10 Displaying the data during a measurement 24
3.11 Pausing and Resetting a measurement 25
3.12 Stopping the measurement 25
3.13 Viewing the stored measurements 26
4 Configuring the Sound Level Meter 27
4.1 Keypad 27
4.2 Menu System 27
4.3 Measurement Mode 28
4.4 Measurement Duration 30
4.5 Measurement Auto Repeat 31
4.6 Measurement Auto Synchronise 33
4.7 Measurement Range 34
4.8 Instrument Setup 36
5 Viewing and Downloading the measurements 43
5.1 Recalling Stored Measurements 43
5.2 Checking & Clearing the memory 45
5.3 Downloading Measurements to the Software 48
5.4 Software Installation 48
5.5 System Requirements 48
5.6 Installation Requirements 48
5.7 Connecting the instrument to the PC 49
5.8 Understanding how the measurements are stored 50
6 Maintenance & Care 52
7 Troubleshooting 53
7.1 Basics 53
7.2 Calibration 53
7.3 Measurements & Settings 54
7.4 Downloading Measurements 54
8 Glossary 55
9 Appendix 1 Specifications 58
9.1 Instrument Versions 58
9.2 Applicable Standards 58
9.3 Microphone 58
9.4 Microphone Preamplifier 58
9.5 Extension cables 58
9.6 Time Weightings 58

9.7 Frequency Weightings 58
9.8 Amplitude Weighting 59
9.9 Measurement Range 59
9.10 Noise Floor (Typical) 59
9.11 Available Measurements 59
9.12 Frequency Bands (Nominal Frequencies) 60
9.13 Memory 60
9.14 Automatic Measurements 60
9.15 Display 60
9.16 Weight 60
9.17 Dimensions 60
9.18 Batteries 60
9.19 Battery Life 61
9.20 Environmental 61
9.21 External Connections 61
9.22 Output Cables 61
9.23 Software Support 61
9.24 Factory Options 61

10 Appendix 2 Acoustic Calibrators 62
10.1 Operation. 62
10.2 Changing the Battery 64
10.3 Specification. 65
10.4 Technical Information 66
10.5 Free Field Correction 67

11 Appendix 3 CE Certificate of Conformity 68

12 Warranty Information. 69

13 Cirrus Research Offices 70

1 Preface

Thank you for purchasing this CR:800C Series Sound Level Meter from Cirrus Research plc. This powerful instrument provides excellent expansion capability, and has been designed to provide reliable, accurate measurements over a long period of time.

This manual describes the procedure that should be followed to set up and operate the CR:800C Sound Level Meter, including comprehensive technical information, using the optional accessories as well as a troubleshooting guide.

This manual also contains the information regarding the CR:514 and CR:515 Acoustic Calibrators.

If you are a new user of Sound Level Meters or new to the CR:800C Sound Level Meter, first read Section 1 Introduction to familiarise yourself with the features, components and accessories supplied. Then read Section 2 Getting Started for step-by-step instructions on how to use the instrument.

The different versions of the CR:800C are:

CR:811C	Class 1 Broadband Only
CR:812C	Class 2 Broadband Only
CR:821C	Class 1 Broadband with 1:1 Octave Band Filters
CR:822C	Class 2 Broadband with 1:1 Octave Band Filters
CR:831C	Class 1 Broadband with 1:1 & 1:3 Octave Band Filters
CR:832C	Class 2 Broadband with 1:1 & 1:3 Octave Band Filters

The CR:800C Sound Level Meters meet the requirements for Class 1 and Class 2 of IEC 61672-1:2002 standard for Class 1 Group X or Class 2 Group X Sound Level Meters as appropriate.

They also meet the requirements for Class 1 and Class 2 according to IEC 60651 and 60804 depending upon the version of the instrument.

To meet the requirements of ANSI S1.4 for Random Incidence microphone response, an NK:70 Random Incidence Adaptor should be used when making measurements.

1.1 Messages and Symbols

Messages are used in this manual to bring important information to your attention. The different message types are indicated as shown below.

Please read. A note is a hint or advice that helps you make best use of the equipment and accessories.

Pay attention! A caution informs you that improper use of the equipment or failure to follow instructions may cause data loss or may damage the equipment.

2 Introduction

2.1 Main Features

2.2 Measurement Functions

The measurement functions that can be provided by the CR:800C depend upon the options that have been fitted.

Listed below is a summary of the measurements that can be provided by the basic Broadband instrument, and by the addition of the 1:1 Octave Band or the 1:3 Octave Band filters.

If the Auto Repeat function is used, the CR:800C can be made to repeat a broadband measurement up to 999 times. The instrument can also be configured to synchronise the measurement start time with the instrument clock.

2.3 Broadband Measurement Mode

In Broadband Mode, the instrument stores the overall values such as L_{Aeq}, L_{AFmax} and Ln's as well as storing a noise profile, or Time History, during each measurement.

The CR:800C instruments can store up to 1,300 Broadband Measurements which can be of any length, up to a maximum of 99 hours per measurement. With each measurement is stored a noise profile which consists of 1 second Leq samples, with up to a maximum of 11 days of Noise Profile being available.

Function	Frequency Weighting	Displayed as	Maximum value	Minimum value
Sound Level with Fast Time Weighting	A	L_{AF}	L_{AFmax}	L_{AFmin}
	C	L_{CF}	L_{CFmax}	L_{CFmin}
	Z	L_{ZF}	L_{ZFmax}	L_{Zfmin}
Sound Level with Slow Time Weighting	A	L_{AS}	L_{ASmax}	L_{ASmin}
	C	L_{CS}	L_{CSmax}	L_{CSmin}
	Z	L_{ZS}	L_{ZSmax}	L_{Zsmin}
Sound Level with Impulse Time Weighting	A	L_{AI}	L_{AImax}	L_{AImin}
	C	L_{CI}	L_{CImax}	L_{CImin}
	Z	L_{ZI}	L_{ZImax}	L_{ZImin}
Equivalent Continuous Sound Pressure Level with integration time t	A	L_{Aeqt}	-	-
	C	L_{Ceqt}	-	-
	Z	L_{Zeqt}	-	-
Sound Exposure Level (SEL)	A	L_{AE}	-	-
	C	L_{CE}	-	-
	Z	L_{ZE}	-	-
Peak Sound Pressure	C	LCpeak	-	-
Takt Maximum Sound Level DIN 45641 (L_{AFTeq})	A	LAFTeq	-	-
Impulse Weighted Equivalent Sounds Press Level with integration time t (L_{Ieqt})	A	LAIeqt	-	-
	C	LCIeqt	-	-
	Z	LZIeqt	-	-

Please note that only one Frequency Weighting can be selected at any time.

2.4 1:1 & 1:3 Octave Band Measurement Mode

If the instrument has been fitted with the 1:1 Octave Band or the 1:3 Octave Band filters, these measurements will be available.

In the 1:1 or 1:3 Octave Band Filter Mode, the CR:800C instrument provide a sequential sweep through the filter bands over the measurement duration. In addition to the frequency bands, the instruments also provide a measurement of the overall L_{Aeq}, L_{Ceq} and L_{Zeq} functions.

Function	Frequency Weighting	Displayed as	Stored Measurement	Applies to
Sound Level with Fast Time Weighting	Z	LZF	No	1:1 & 1:3 Octave Bands
Equivalent Continuous Sound Pressure Level with integration time t	Z	LZeqt	Yes	1:1 & 1:3 Octave Bands
	A	LAeqt	Yes	Broadband
	C	LCeqt	Yes	Broadband
	Z	LZeqt	Yes	Broadband

The 1:1 Octave Band Filters cover the following frequency bands: 31.5Hz to 16kHz

The 1:3 Octave Band Filters cover the following frequency bands: 25Hz to 16kHz

When the MO:800/6 Options is fitted, the 1:3 Octave Band Filters include the additional 20Hz and 20kHz 1:3 Octave Band Filters.

2.5 Options & Accessories

The CR:800C Series are also available with a range of options and accessories that can enhance the performance and applications of the instrument. For full details, please contact Cirrus Research plc or your local representative.

The most commonly used accessories are listed below.

CR:514	Class 2 Acoustic Calibrator
CR:515	Class 1 Acoustic Calibrator
UA:237	Windshield
CK:250	Carrying Case
CP:65	Carrying Pouch for Sound Level Meter
CT:1	Tripod
CM:270/1	Preamplifier Tripod Mount
ZL:202	2m Microphone Extension Cable
ZL:205	5m Microphone Extension Cable
ZL:210	10m Microphone Extension Cable
ZL:225	25m Microphone Extension Cable
ZL:100	USB Data Cable
ZL:812	AC Output Cable to Phono Connector
ZL:813	RS232 Output Cable
CK:408C	Outdoor Measurement Kit
CK:508C	Lightweight Outdoor Measurement Kit
CU:800C	Mains Power Supply (UK/US/EU)
SW:DD3	Deaf Defier3 Software

3 Getting Started

3.1 How to...

These example settings are designed to demonstrate the different configurations that are available from the CR:800C Sound Level Meters. Please check the configuration of the instrument to match the measurement requirements of your application before making a measurement.

Make a 15 minute Broadband Measurement

1. Switch on
2. Calibrate
3. Set Measurement Mode to Broadband
4. Set measurement duration to 15 minutes
5. Switch off Auto Repeat & Auto Synchronise
6. Set Measurement Range
7. Start Measurement
    a. Run for 15 minutes
8. Stop Measurement
9. Review Measurement Data

Make a 1:1 Octave Band Measurement over 1 minute

1. Switch on
2. Calibrate
3. Set Measurement Mode to 1:1 Octave Band
4. Set Measurement Duration to 1 minute
5. Set Measurement Range
6. Start Measurement
    a. Run for 1 minute
7. Stop Measurement
8. Review Measurement Data

Make a 1:3 Octave Band Measurement over 5 minutes

1. Switch on
2. Calibrate
3. Set Measurement Mode to 1:3 Octave Band
4. Set Measurement Duration to 5 minutes
5. Set Measurement Range
6. Start Measurement
    a. Run for 5 minutes
7. Stop Measurement
8. Review Measurement Data

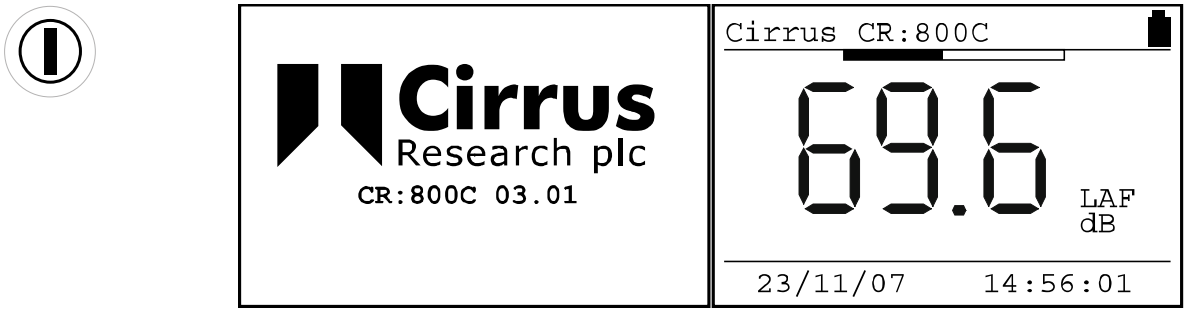
Make a set of twenty four 1 hour measurements

1. Switch on
2. Calibrate
3. Set Measurement Mode to Broadband
4. Set Measurement Duration to 1 hour
5. Set Auto Repeat to On
6. Set Number to 25
7. Set Auto Synchronise to On
    a. Start Measurement
8. After 24 1 hour measurements the instrument will stop
9. Review Measurement Data

3.2 Quick Start

Switch on

Key Press Display



When the instrument has switched on, the start-up screen will change to the standard noise level display.

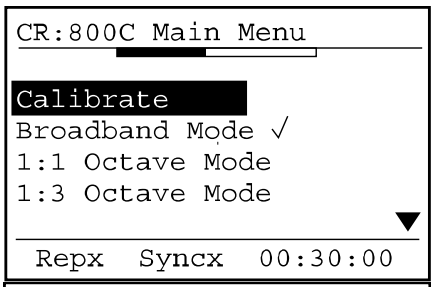
Calibrate the Sound Level Meter

If a microphone extension cable is to be used during a measurement, the instrument must be calibrated with the cable attached.

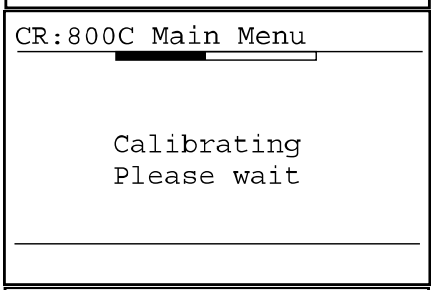
Connect the Acoustic Calibrator to the Sound Level Meter and select the 94dB setting on the Acoustic Calibrator. Press the Menu key to select the Calibrate option and press OK to start the calibration procedure.

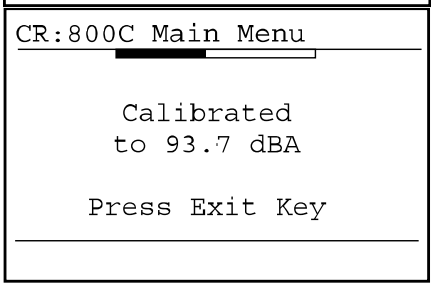
Key Press Display

Menu



OK



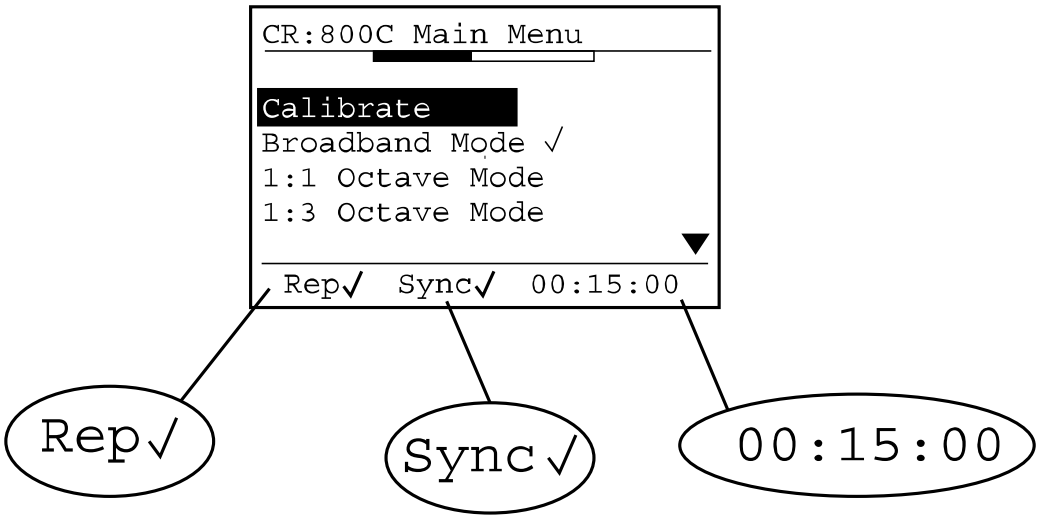


If the calibration is successful , press the exit key to return to the main screen.

Set the measurement duration

Press the menu key to view the current measurement duration and the status of the auto repeat and auto synchronise function. At the bottom of the screen is the current configuration.

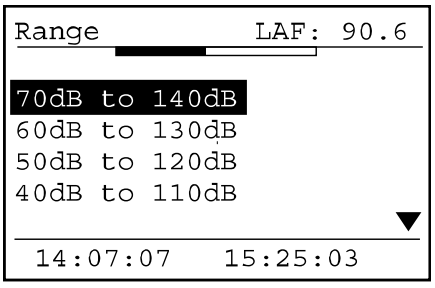
In this example, the measurement duration is set to 15 minutes. The Auto-Repeat function is switched on. The Auto-Synchronise function is switched on.



If the measurement duration is not as required, use the Measurement Duration menu option to set the required measurement duration. Refer to page 30 for details of setting the measurement duration.

Check the measurement range

Press the Range key to check the current measurement range.

Key Press	Display	Comments
Range		In this example, the measurement range is set to 70dB to 140dB.

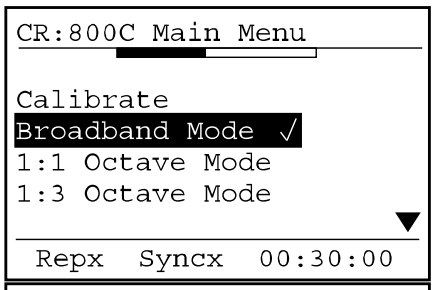
To change the measurement range, use the Up and Down Arrow keys to highlight the required measurement range press OK.

Change the measurement function

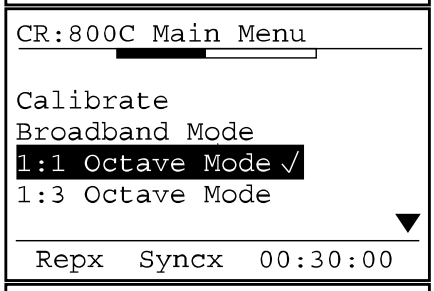
To check the current measurement function and to change the measurement function, press the menu key. Use the Up and Down arrows keys to select the required measurement mode and OK to Select the mode required.

Key Press	Display	Comments

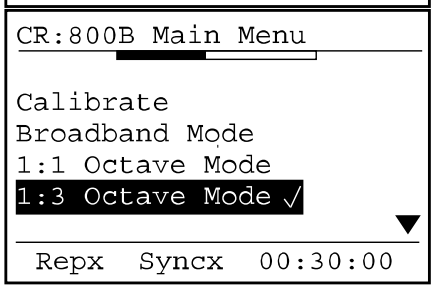
Menu



In this example, the instrument is set to Broadband Measurement Mode



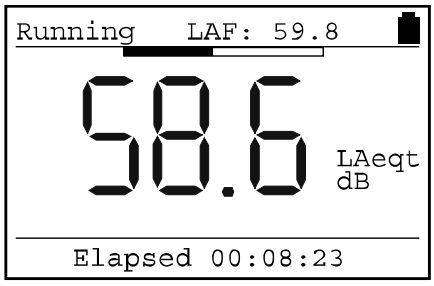
In this example, the instrument is set to 1:1 Octave Band Measurement Mode



In this example, the instrument is set to 1:1 Octave Band Measurement Mode

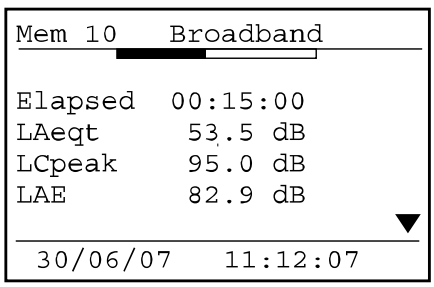
Start & Stop the measurement

To start the measurement, press the Start Key

Key Press	Display	Comments
		

Press the Up and Down arrow keys to view the measurement functions during the measurement.

To stop the measurement, press the Stop Key.

Key Press	Display	Comments
		The instrument stores the measurement in memory and enters the measurement review mode.

Review the measurement

When the measurement has been stopped, the instrument automatically stores the measurement in memory and enters the measurement review mode. Use the Up and Down arrow keys to view the different measurement values and press the exit key to return to the main display.

3.3 Unpacking and checking the Sound Level Meter

Carefully remove the instrument from its shipping container and inspect it for possible damage or missing items. If the meter appears to be damaged or something is missing, contact Cirrus Research plc or your local representative immediately.

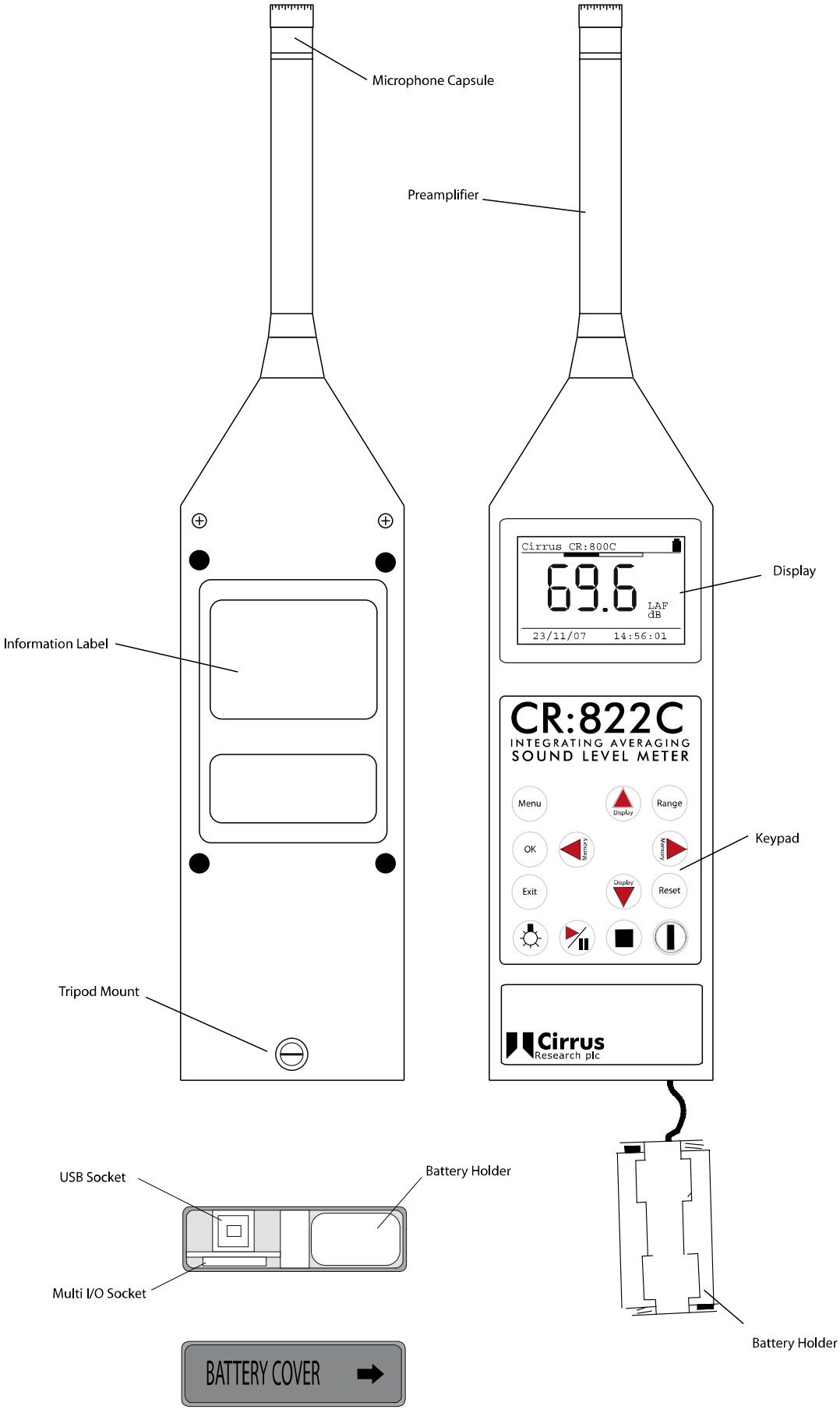
The basic CR:800C instrument is supplied with the following standard accessories:

Deaf Defier3 for Windows Software on CD-ROM
CR:800C User Manual
Certificates of Calibration
ZL:100 USB Data Cable
Batteries 2 x AA

In addition, the Class 1 versions of the instrument are supplied with an MV:200D Preamplifier and a microphone box.

If you have ordered the instrument as a complete measurement kit, you will have also received some further items such as an Acoustic Calibrator, Carrying Case and Windshield.

3.4 Instruments Layout



3.5 Assembly

The CR:800C instruments are supplied fully assembled apart from the MV:200D Preamplifier for Class 1 instruments and the batteries.

Preamplifier

The Class 1 versions of the CR:800C (CR:811C, CR:821C and CR:831C) are supplied with a removable preamplifier, the MV:200D. Also, a removable preamplifier may be fitted as an option to the Class 2 instruments.

This preamplifier must be connected to the Sound Level Meter ***before*** the unit is switched on. This unit is connected to the top of the CR:800C using a locking ring. To connect the MV:200D Preamplifier, follow the diagram below:

(1) Place the preamplifier into the socket on the Sound Level Meter
(2) Ensure the connector has located into the socket
(3) Tighten the Locking Ring.

Do not cross thread the locking ring. Damage caused by misuse is not covered by the warranty for the instrument.

Removing the Preamplifier:

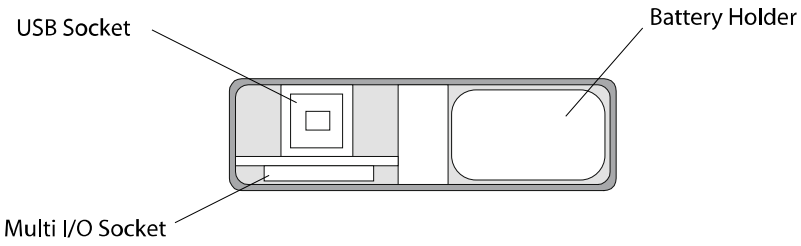
Do not twist the preamplifier body. Unscrew the locking ring and pull the preamplifier from the Sound Level Meter.

Using Microphone Extension Cables

The CR:800C instruments can be used with a microphone extension cable if the instrument is fitted with the removable preamplifier. If a microphone extension cable is to be used during a measurement, the instrument must be calibrated with the cable attached. Connect the microphone extension cable in the same manner as the MV:200D Preamplifier.

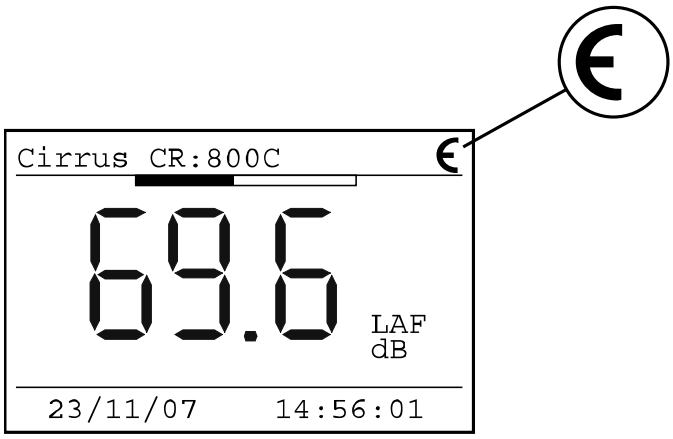
Batteries

The batteries of the CR:800C are located behind the cover on the bottom of the instrument. Slide the cover to the right hand side to remove and to access the battery holder. Ensure the instrument is switched off. Remove the battery holder from the instrument and insert the batteries. The CR:800C instruments uses two AA type batteries, also known as LR6.



Ensure that the batteries are inserted correctly. ***DO NOT*** reverse the polarity of the batteries as this may cause damage to the instrument.

Using an external power supply



The CR:800C can be used with an external power supply. When the external supply is connected, the CR:800C switches automatically from the internal battery power.

When the external power is either removed or switched off, the instrument will automatically switch back to the internal battery supply.

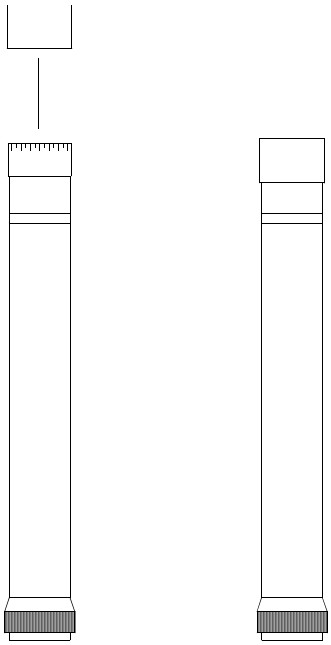
When an external supply is connected, the display of the instrument will show a symbol in the top right corner as shown below.

Windshield

The CR:800C Series can be used with a UA:237 90mm foam windshield which will reduce the noise levels generated by air turbulence over the microphone capsule.

The windshield can also be used to protect the microphone capsule of the sound level meter from dust and fluids which may affect the performance of the instrument. To use the UA:237 windshield, push the hole in the windshield over the microphone of the sound level meter. The UA:237 windshield must be removed before the sound level meter can be calibrated.

NK:70 Random Incidence Adaptor



The NK:70 Random Incidence Adaptor is designed to modify the response of the microphone capsule from Free Field to Random Incidence in order to comply with the requirements of ANSI S1.4.

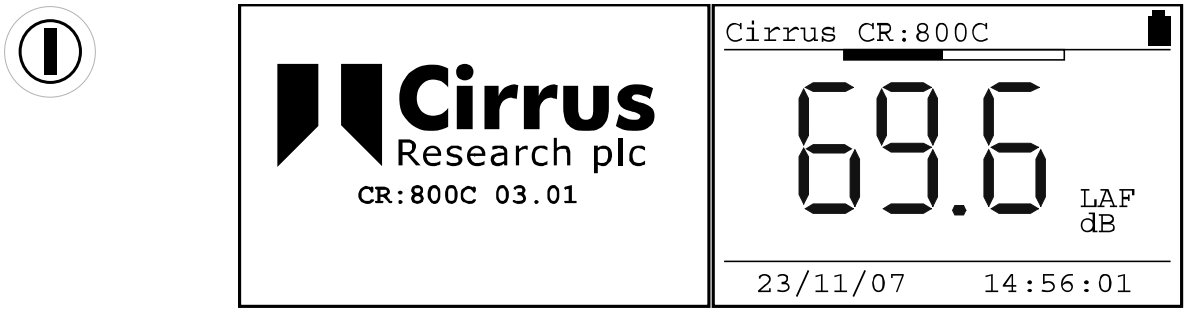
For instruments supplied for use outside of the USA, this adaptor may not be supplied.

To fit the NK:70 Random Incidence Adaptor, push the adaptor over the microphone grill. Do not attempt to remove the microphone grill as this may cause damage to the capsule.

To calibrate the instrument remove the NK:70 Adaptor. Do Not attempt to calibrate the instrument with the NK:70 fitted.

3.6 Switching On

Key Press Display

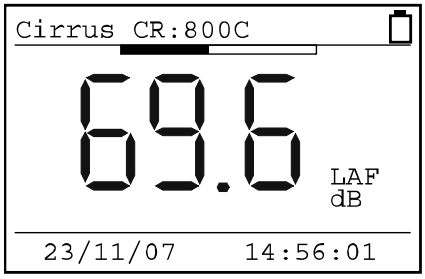


When the instrument is first switched on, a Welcome screen is shown with the instrument type and version number. After 3 seconds, the display will change and the current Sound Level will be shown with the current configuration shown as above.

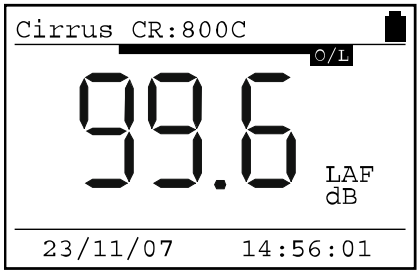
In this example, the instrument is showing the Fast A-Weighted Sound Level with the current date and time shown at the bottom of the screen. The battery level is shown in the top right hand corner of the display.

Across the top of the display, above the numbers, is shown the sound level as a bar graph. This graph is scaled with the current measurement range.

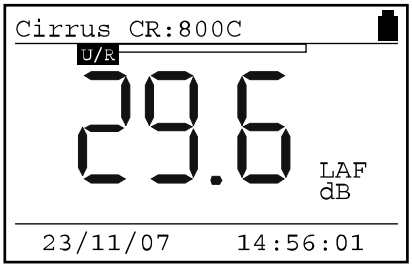
The display will also show when the instrument is in Overload or Under Range. The Glossary on page 55 also describes the indication of Overload and Under Range.



Low Battery Level



Overload

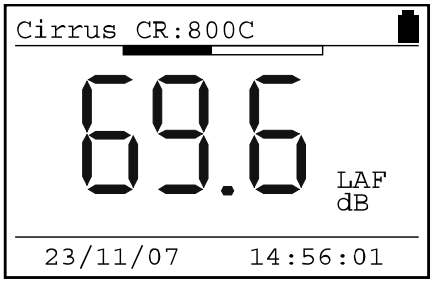


Under Range

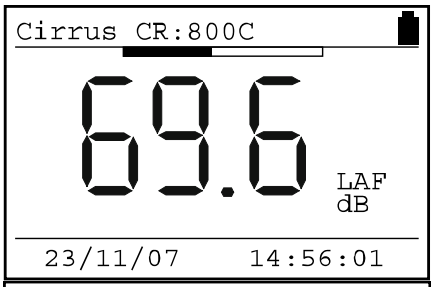
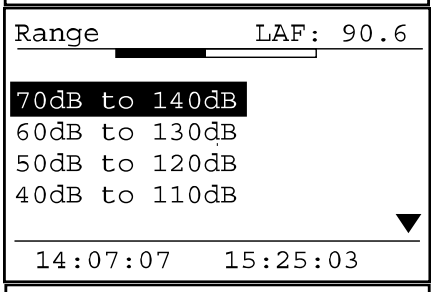
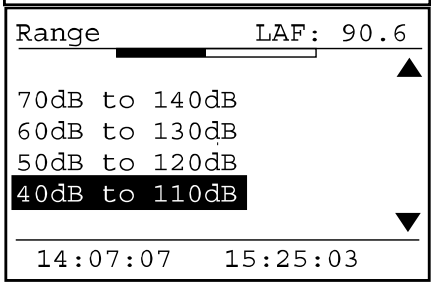
3.7 Checking the Configuration of the Instrument

The Setup of the instrument should be checked before making a measurement.

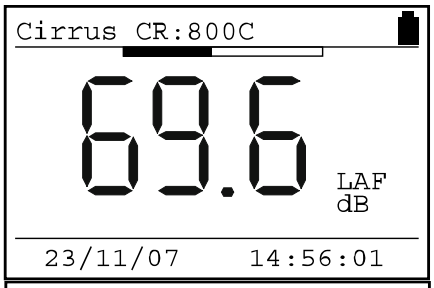
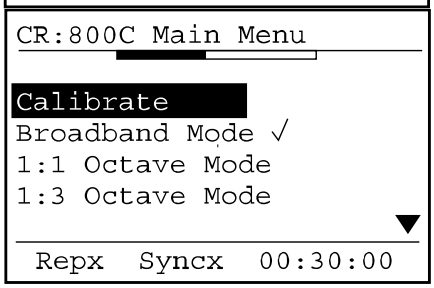
Time and Date

Key Press	Display	Comments
		The current time and date are shown at the bottom of the screen.

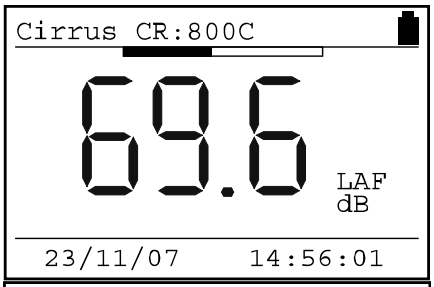
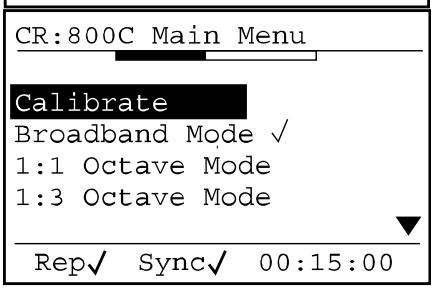
Measurement Range

Key Press	Display	Comments
		
Range		The current measurement range is shown highlighted. Use the Up and Down Arrows to select the required range.
		Press the OK key to change the range or Exit to discard. The bar at the top of the screen shows the noise level in proportion to the measurement range.

Measurement Mode

Key Press	Display	Comments
		
Menu		The current measurement mode is shown on the screen. In this example, the measurement mode is Broadband.

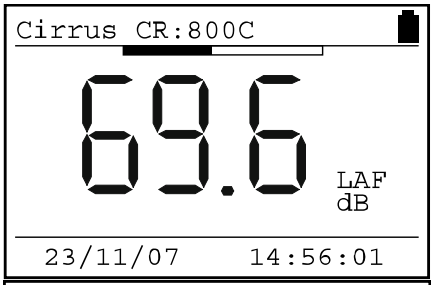
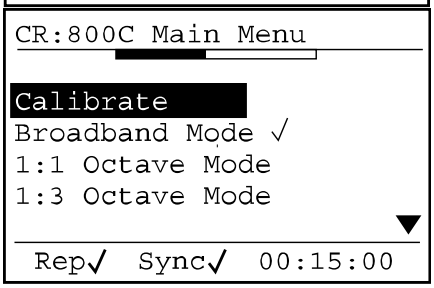
Measurement Duration

Key Press	Display	Comments
		
Menu		The measurement duration is shown at the bottom of the screen. In this example, the measurement time is 15 minutes.

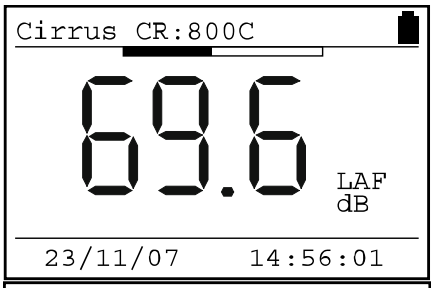
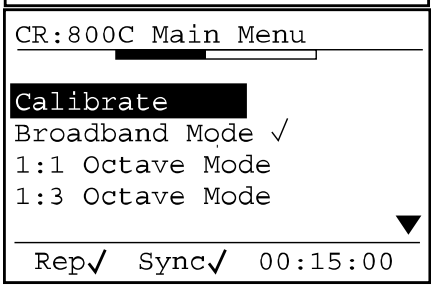
When the instrument is set to either 1:1 or 1:3 Octave Band Mode, the Run Duration is divided between the frequency bands. For example, if the measurement duration is set to 15 minutes, the CR:800C instrument will take a ***total*** of 15 minutes to complete the sweep through the frequency bands.

To meet the accuracy required by the standards to which the instrument is designed to meet, there is a minimum time required to measure each frequency band. Therefore, the CR:800C enforces a minimum measurement duration of 1 minute for the 1:1 Octave Band Mode and 3 minutes for the 1:3 Octave Band Mode.

Measurement Auto Repeat

Key Press	Display	Comments
		
Menu		The status of the Auto Repeat is shown at the bottom of the screen. In this example, the Auto Repeat is switched on. When the Auto Repeat is switched off, the display is Repx

Measurement Auto Synchronise

Key Press	Display	Comments
		
Menu		The status of the Auto Synchronise is shown at the bottom of the screen. In this example, the Auto Synchronise is switched on. When the Auto Synchronise is switched off, the display is Syncx

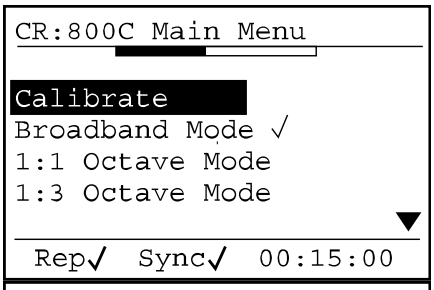
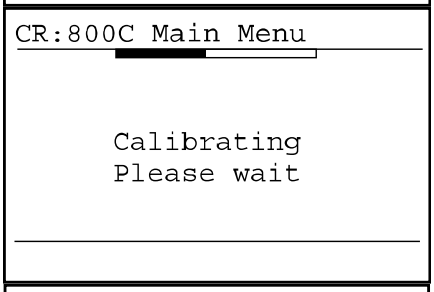
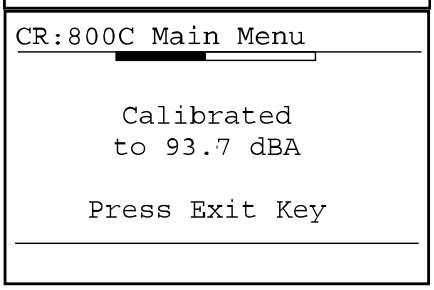
Configuring the instrument from the Deaf Defier3 software

The entire configuration of the instrument can be set from the Deaf Defier3 software using the Advanced Configuration option.

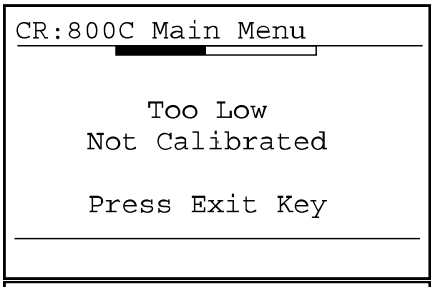
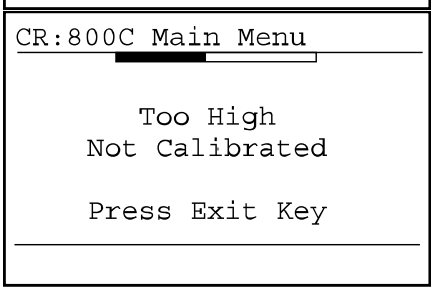
3.8 Calibration

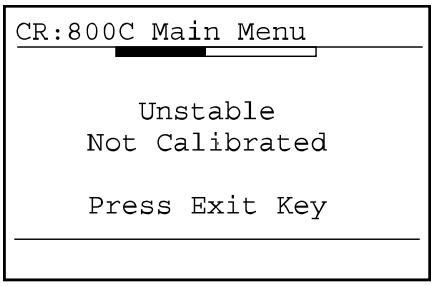
If a microphone extension cable is to be used during a measurement, the instrument must be calibrated with the cable attached.

Attach the acoustic calibrator to the sound level meter, and press the menu key. The first menu option is Calibrate.

Key Press	Display	Comments
Menu		Select 94dB on the Acoustic Calibrator before starting the calibration procedure.
		
		If the calibration is sucessful, the instrument will display the calibration information screen. Press Exit to return to the main screen.

If the instrument cannot calibrate successfully, the display will show an error:

		The calibration level is too low. The Calibrator may not be switched on or may not be functioning correctly.
		The calibration level is too high. Check that the calibration level on the Acoustic Calibrator is set to the correct level. The default level is 94dB

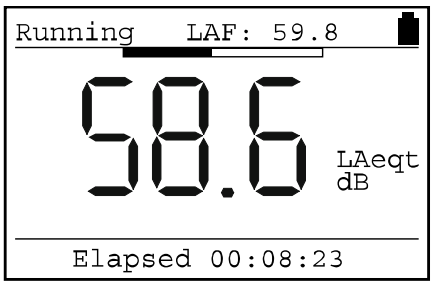


The calibration level is unstable.

The background noise level may be too high or the acoustic calibrator may not be fitted correctly to the sound level meter.

3.9 Starting a measurement

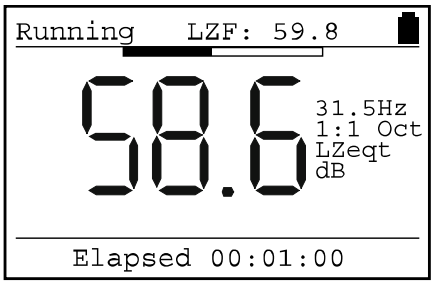
Broadband Mode

Key Press	Display	Comments
		When the measurement is running, the display shows "Running" in the top left hand corner.

If the user does not stop or reset the measurement, the instrument will run for the preset measurement duration. At the end of the measurement, the information will be automatically stored in the memory.

If the Auto-Repeat function is enabled, the next measurement will start automatically at the end of the previous measurement.

1:1 Octave Band Mode

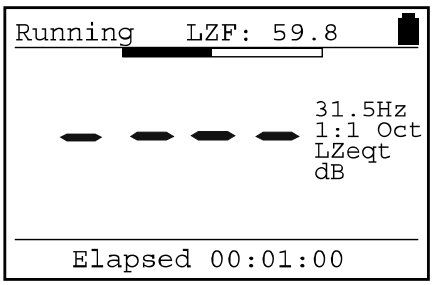
Key Press	Display	Comments
		When the measurement is running, the display shows "Running" in the top left hand corner.

If the measurement duration is set to Manual, the 1:1 Octave Band frequency will stay on the current frequency until the Up arrow is pressed. At the end of the measurement, the user must press the Stop key to end the measurement and store the information in the memory.

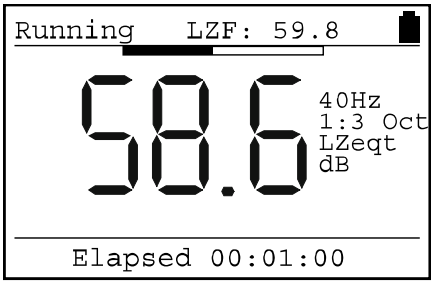
When the measurement duration is set to any option other than Manual, the instrument will automatically sweep through the 1:1 Octave Bands in the set duration. After the 16kHz 1:1 Octave Band, the instrument will measure a dB(A), dB(C) and then a dB(Z) value and then stop, storing the measurement in the memory.

The user can override the automatic sweep by pressing the Up arrow key to step to the next frequency band.

The display will show ---- until enough data has been accumulated to give an accurate measurement.

Key Press	Display	Comments
		The instrument has not accumulated sufficient data to give an accurate measurement. When enough information has been gathered, the LZeq value will be displayed.

1:3 Octave Band Mode

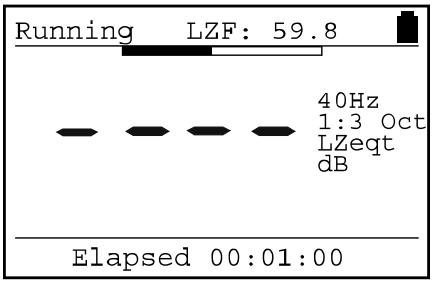
Key Press	Display	Comments
		When the measurement is running, the display shows "Running" in the top left hand corner.

If the measurement duration is set to Manual, the 1:3 Octave Band frequency will stay on the current frequency until the Up arrow is pressed. At the end of the measurement, the user must press the Stop key to end the measurement and store the information in the memory.

When the measurement duration is set to any option other than Manual, the instrument will automatically sweep through the 1:3 Octave Bands in the set duration. After the 16kHz 1:3 Octave Band, the instrument will measure a dB(A), dB(C) and then a dB(Z) value and then stop, storing the measurement in the memory.

The user can override the automatic sweep by pressing the Up arrow key to step to the next frequency band.

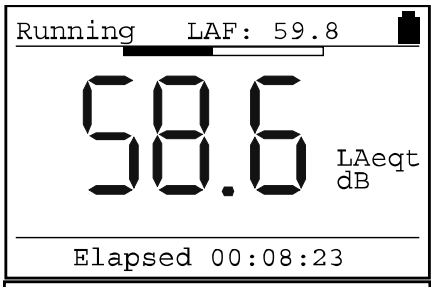
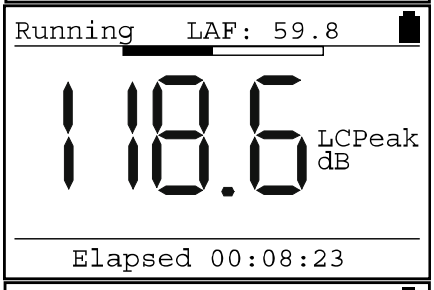
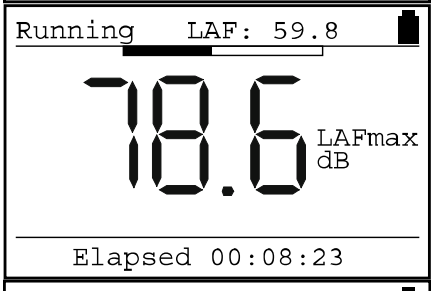
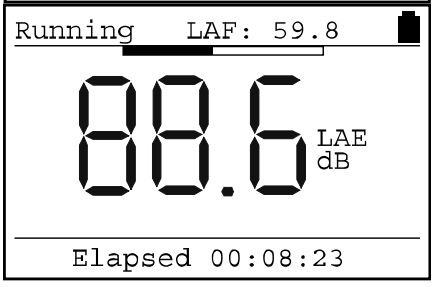
The display will show ---- until enough data has been accumulated to give an accurate measurement.

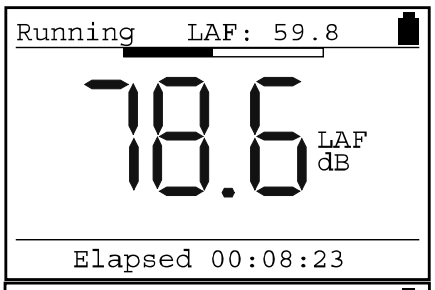
Key Press	Display	Comments
		The instrument has not accumulated sufficient data to give an accurate measurement. When enough information has been gathered, the LZeq value will be displayed.

3.10 Displaying the data during a measurement

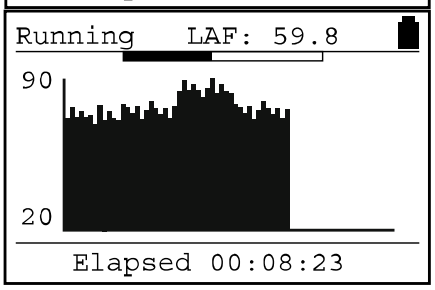
Broadband Mode

During a Broadband Mode measurement, the user can step through the different measurement parameters. All of the functions are measured simultaneously and are automatically stored. Please note that this function is only available in Broadband Mode.

Key Press	Display	Comments
		The instrument starts with the LAeq,t value and the Elapsed Time. The Sound Level, in this case LAF, is shown in the top right hand corner of the screen.
Display		The Peak(C) value is shown
Display		The Maximum Sound Level, LAFmax in this example, is shown
Display		The Sound Exposure Level, or LAE is shown. If the User Metric is configured for either the LAFTeq or LIeq,t functions, these will be shown instead of the LAE value.



The Sound Level is shown, in this case the LAF.

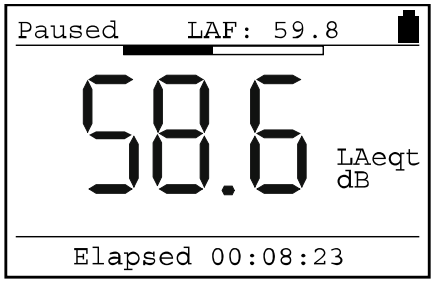


The real time display of the noise level is shown as 1 second Leq samples.

The display shows 2 minutes of information and then starts to scroll across the screen.

3.11 Pausing and Resetting a measurement

During a measurement, the user can pause the measurement by pressing the Start/Pause key.

Key Press	Display	Comments
		The measurement is paused.

To restart the measurement, press the Start/Pause key again.

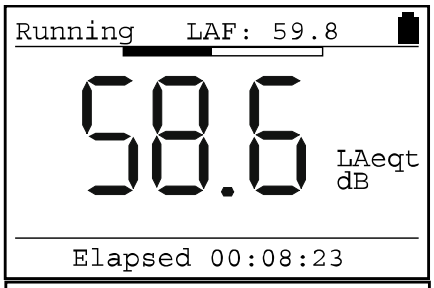
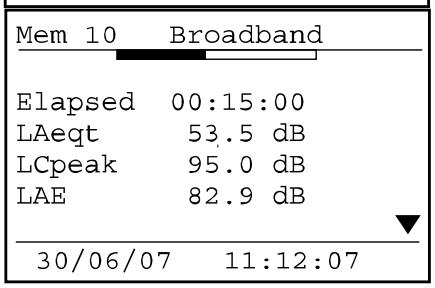
When a Broadband measurement is paused, the collection of data for the overall parameters, such a the Leq, is paused. However, the Time History measurement continues and the instrument codes this data. When the information is downloaded to the Deaf Defier3 software, the user can see when the measurement was paused.

Information recorded by the Time History store when the instrument is in pause mode is not used in the calculation of the overall parameters.

The user can reset and discard the current measurement when the instrument is running by pressing the Reset key. This will delete the current measurement information and restart the measurement.

3.12 Stopping the measurement

At any time during a measurement, the user can stop the measurement. The data will be automatically stored in memory, and the display will change to the memory review mode.

Key Press	Display	Comments
		
■		When the Stop key is pressed, the current measurement is stored in the memory and the display changes to the memory review mode. In this example, the measurement is a Broadband measurement.

3.13 Viewing the stored measurements

After a measurement has been stopped

When the measurement is stopped, the data is automatically stored in memory and the instrument enters the measurement review mode.

Use the Up and Down arrow keys to review the measurement data.

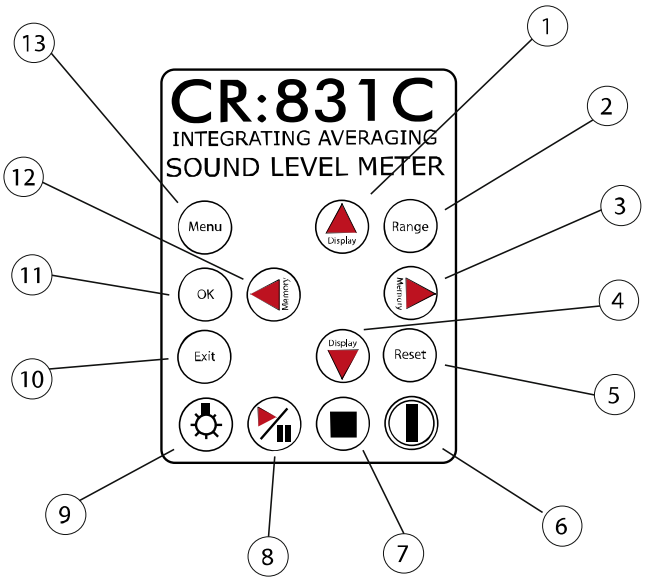
Recalling stored measurements

Measurements can be recalled at any time to the instrument display.

4 Configuring the Sound Level Meter

This section of the manual covers the configuration of the Sound Level Meter and the different options that are available to the user.

4.1 Keypad



(1) Move through the measurement parameters when running a measurement.
Move through the stored measurement parameters in memory recall mode.
Select a higher frequency band in 1:1 and 1:3 Octave Band Filter mode.
Step up through menu options
(2) Change the measurement range and display the current measurement range
(3) Enter Memory Recall Mode and step through the memory locations
(4) Move through the measurement parameters when running a measurement.
Move through the stored measurement parameters in memory recall mode.
Select a lower frequency band in 1:1 and 1:3 Octave Band Filter mode.
Step down through menu options
(5) Resets the current measurement when running
(6) Power On and Off
(7) Stops the current measurement when running
(8) Start and Pause a measurement
(9) Switch on and off the display backlight
(10) Exit menu option. Cancel data entry
(11) Select menu option. Accept data entry
(12) Enter Memory Recall Mode and step through the memory locations
(13) Select the menu mode and view the menu options

4.2 Menu System

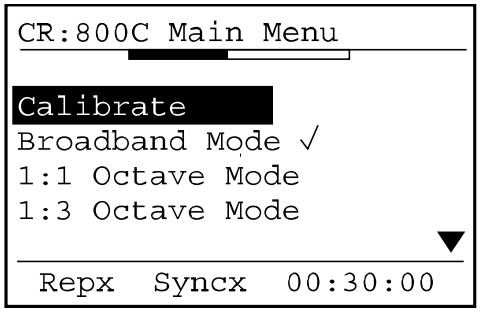
The CR:800C instruments use a menu system to allow the user to change the operation of the Sound Level Meter. This menu system is described below along with the procedure to change the different measurement functions and operational parameters.

4.3 Measurement Mode

To select the Measurement Mode, press the Menu Key. The current measurement mode is displayed.

Key Press Display

Menu



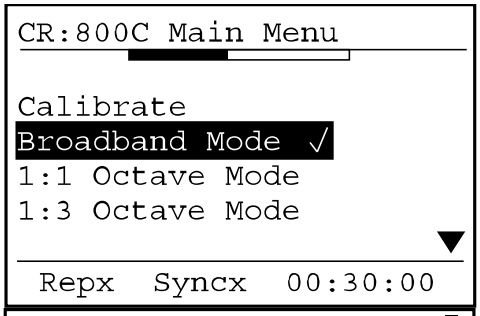
Broadband Mode

To select the Broadband Measurement Mode:

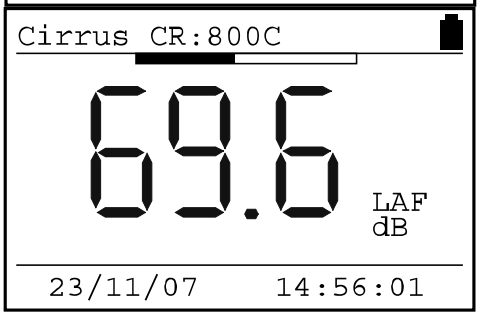
Key Press Display

Display

OK



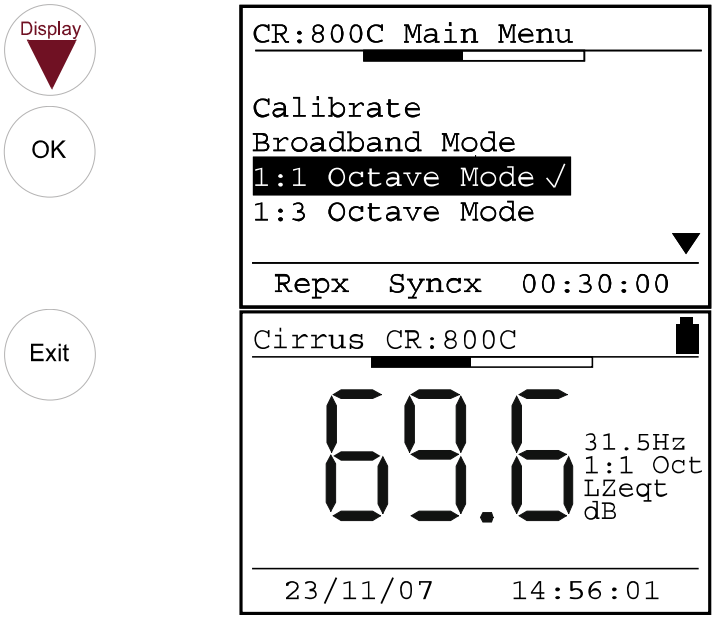
Exit



1:1 Octave Band Mode

To select the 1:1 Octave Band Measurement Mode:

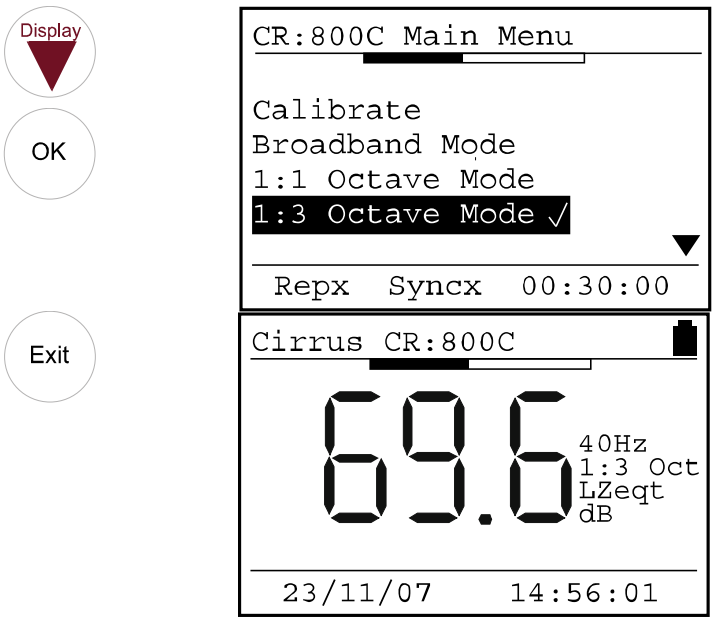
Key Press Display



1:3 Octave Band Mode

To select the 1:3 Octave Band Measurement Mode:

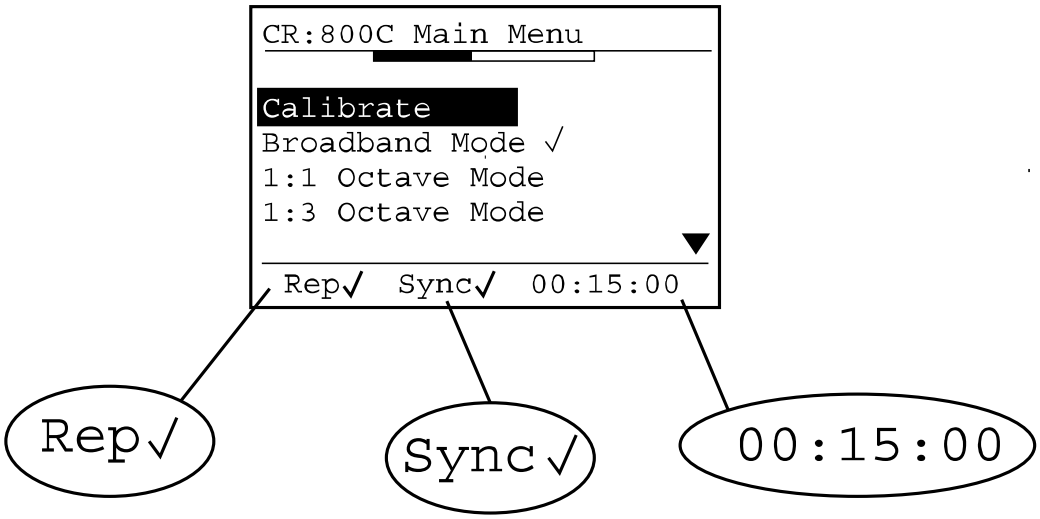
Key Press Display



4.4 Measurement Duration

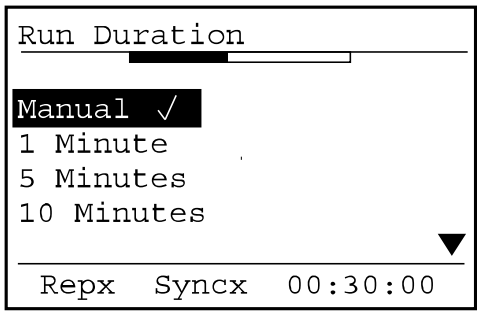
The configuration of the Run Duration, the Auto-Repeat and the Auto-Synchronise functions are all connected and affect each other.

Always ensure that the status of these three functions is checked before making a measurement. When the menu key is pressed, the display shows the status of these functions as shown below.

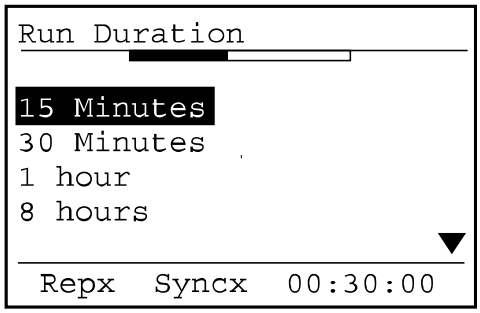


To change the measurement duration of the instrument:

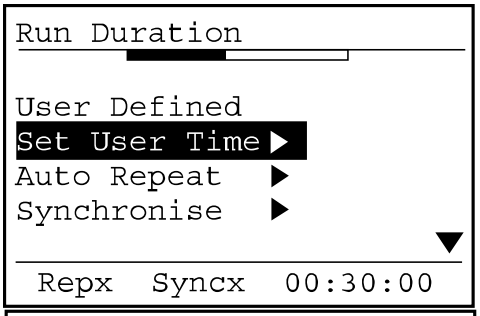
Key Press	Display
Menu	CR:800C Main Menu Calibrate Broadband Mode √ 1:1 Octave Mode 1:3 Octave Mode Repx Syncx 00:30:00
Display	CR:800C Main Menu Run Durations ▶ Memory ▶ Setup ▶ Print Options Repx Syncx 00:30:00
Display	
Display	
Display	

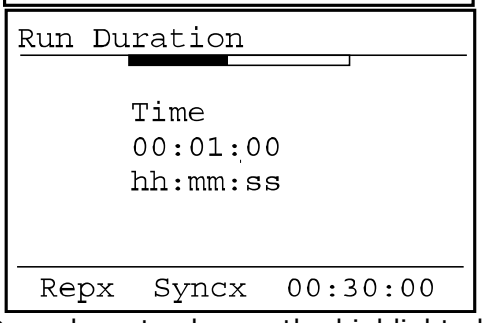


In this example, the measurement duration will be set to 15 Minutes, and the instrument will run continuously until the Stop key is pressed. The change the measurement duration, use the Up and Down keys to select the require duration and press OK to select.



In addition to the preset measurement durations, the user can define the measurement duration using the Set User Time Option.





Use the Up and Down keys to change the highlighted parameter and the Left and Right keys to move through the different fields. Press OK to accept the User Time.

4.5 Measurement Auto Repeat

The auto-repeat function is used to set the instrument to make a series of contiguous measurements. For example, if the measurement duration was set to 15 minutes and the Auto Repeat disabled, after one 15 minute measurement the instrument will stop and store the measurement information the memory.

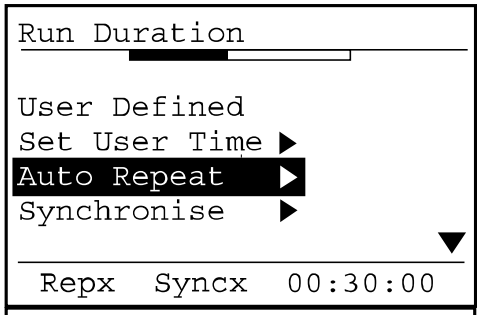
Please note that this function only operates in the Broadband Measurement. Auto Repeat is not available during 1:1 or 1:3 Octave Band Mode.

With the Auto Repeat function enabled, the instrument will make further 15 minute measurements, one after the next until the total number of measurements has been made. This allows the user to tell the instrument, for example, to make 96 individual 15 minute measurements over a 24 hour period.

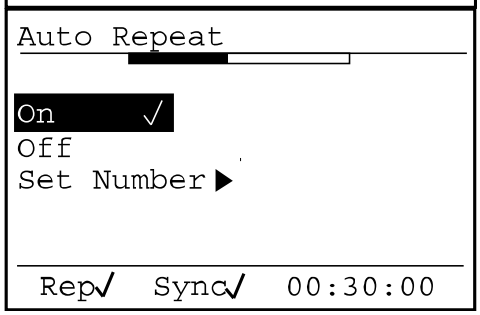
To configure the Auto Repeat function, enter the menu and select the Measurement Duration option and then select the Auto Repeat option.

Key Press Display

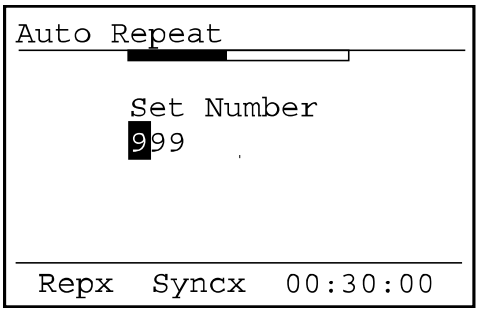
OK



OK



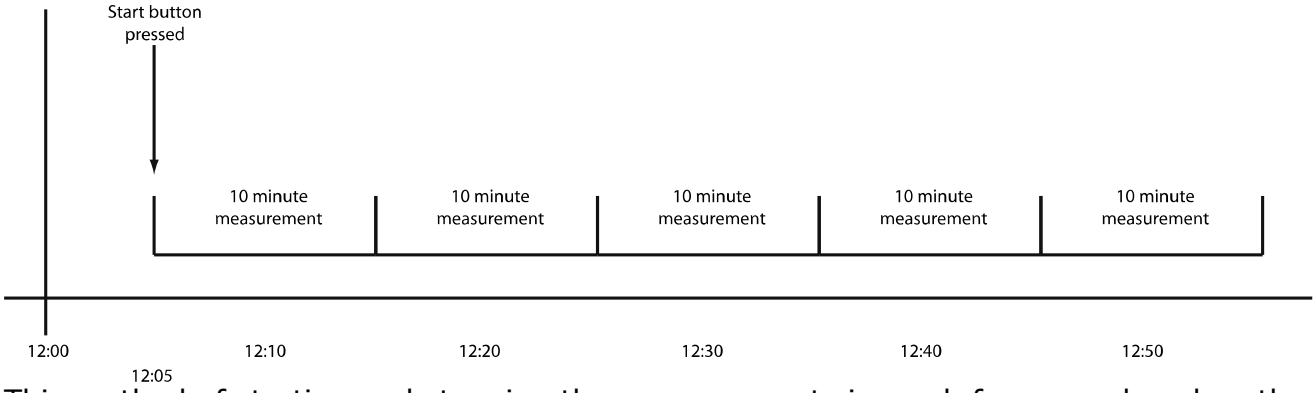
Use the up and down arrows to change the number of measurements required and the left and right arrows to move between the digits. Press OK to accept the changes or Exit to discard any changes made.



4.6 Measurement Auto Synchronise

This function allows the start of the measurements to be started in time with the clock of the instrument.

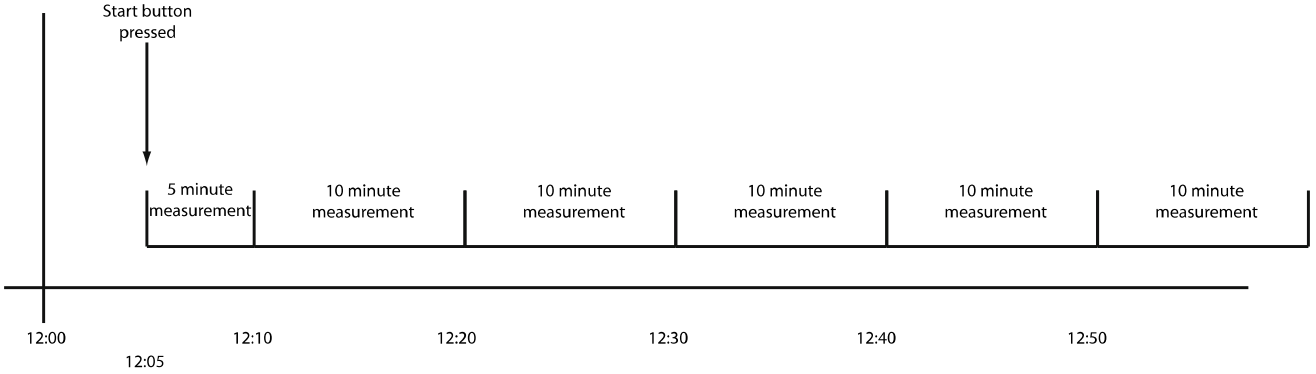
The diagram below shows how the measurement runs from when the Start key is pressed for the duration defined by the Run Duration when the auto-repeat function is not activated.



This method of starting and stopping the measurements is used, for example, when the application is Occupational Noise and the user wants to control the starting and stopping of the measurement directly.

However, in many applications such as Environmental Noise, it is important to start the measurements at a predetermined time. For example, when making environmental noise measurements that are for 10 minutes, the CR:800C can be set to start the measurements on 10 minute boundaries.

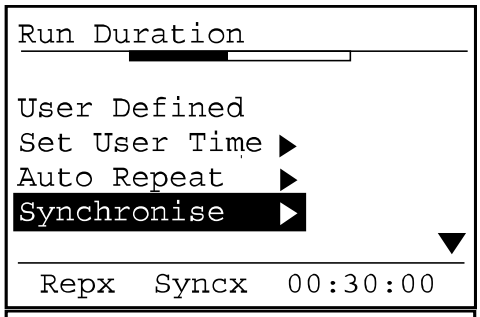
The diagram below show the measurement starts with the Auto Sync function enabled.



To enable the Auto Sync function, select the Run Duration option from the menu and then select the Synchronise function. Use the Up and Down arrows to switch on the off the Auto Synchronise function. Press Exit when finished.

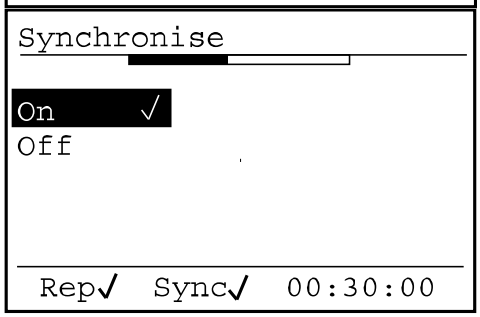
Key Press Display

OK



OK

Exit

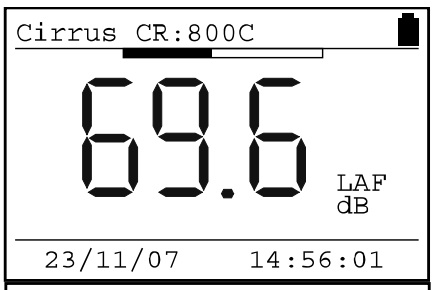
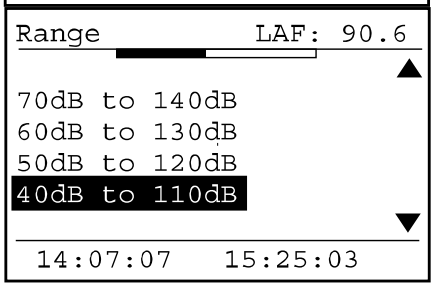


When the Auto Synchronise function has been selected, the display will show the Sync at the bottom of the screen with a tick next to it as shown above.

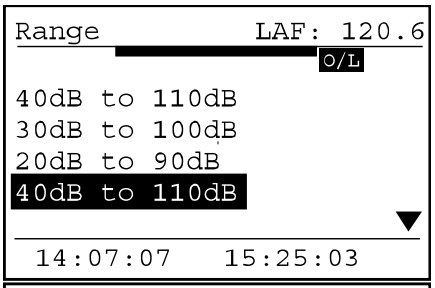
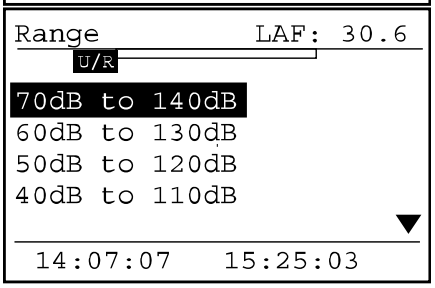
4.7 Measurement Range

One of the most important features of a Sound Level Meter is the measurement range. If the measurement range is set too high, the instrument may not be able to record low levels. If the measurement range is set too low, high noise levels will overload the instrument and make the measurement invalid. Therefore it is vital that the correct measurement range is chosen for the noise to be recorded.

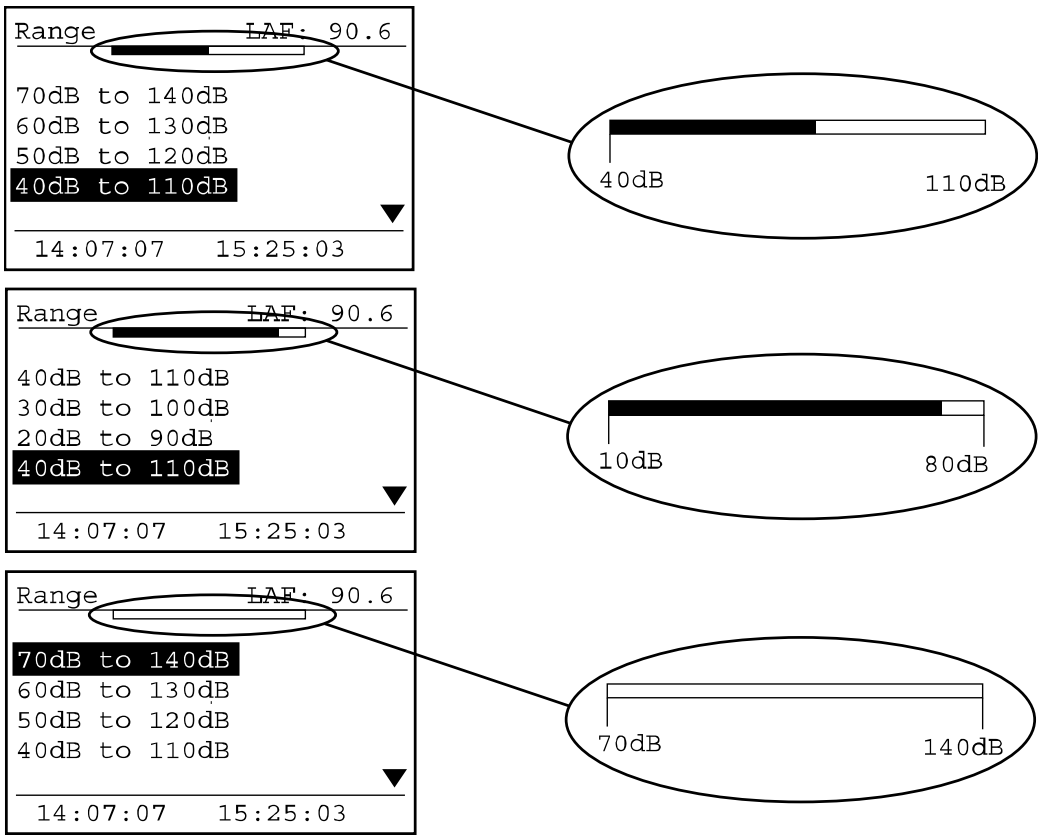
To check the current measurement range, press the Range key.

Key Press	Display	Comments
		
Range		The current measurement range is 40dB to 110dB.

The measurement range in this example is 40dB to 110dB. If the noise level is below 40dB, the instrument will indicate Under-Range. If the noise level is above 110dB, the instrument will indicate Overload.

Display	Comments
	The measurement range is 40dB to 110dB and the noise level is 120.6dB. The instrument is overloading and the O/L symbol is shown.
	The measurement range is 70dB to 140dB and the noise level is 58.9dB. The instrument is under ranging and the U/L symbol is shown.

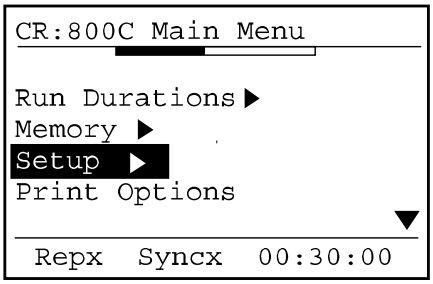
The bar graph at the top of the screen can be used to select the appropriate measurement range. As the user moves between the different measurement ranges, the bar graph changes the top and bottom to match the measurement range. The noise level being measured is shown in the bar graph.



Select the appropriate measurement range to suit the noise levels to be measured.

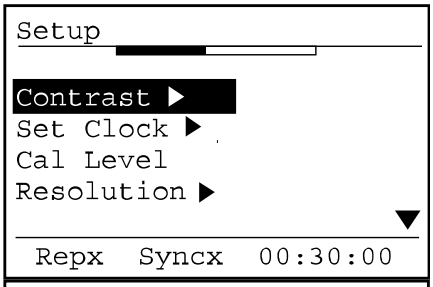
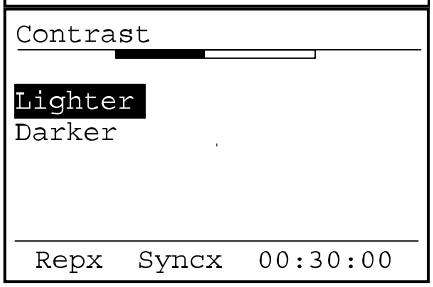
4.8 Instrument Setup

Select the Setup option from the main menu and press OK.

Key Press	Display	Comments
OK		

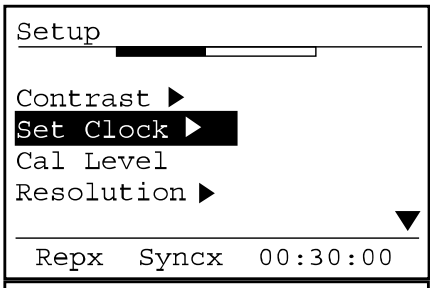
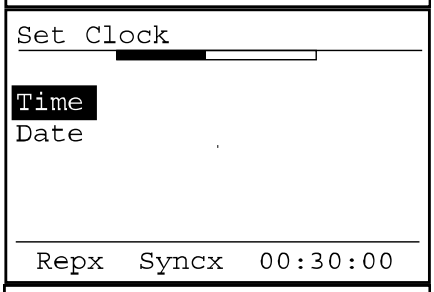
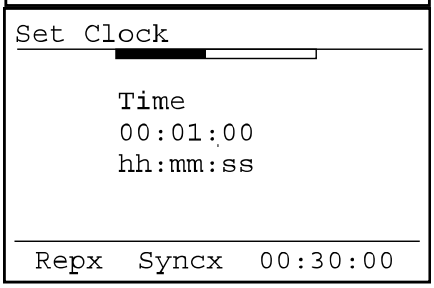
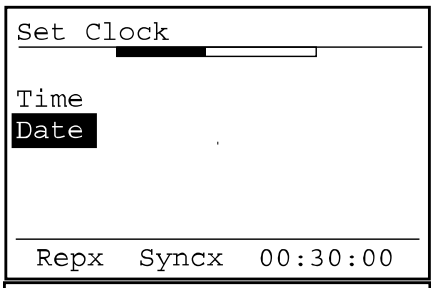
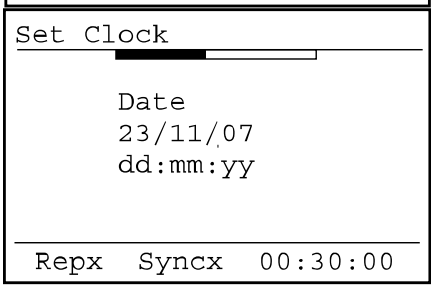
Display Contrast

To adjust the contrast of the display, select the Contrast Option and press OK

Key Press	Display	Comments
		
		Select the Lighter or Darker option and press the OK repeatedly to adjust the selection. Press the Exit button to exit from the Contrast menu.

Time & Date

To change the Date and Time, select the Set Clock option from the Setup Menu.

Key Press	Display	Comments
		
OK		To set the time, select the time option and press OK
		Use the Up and Down arrow keys to change the numbers and the left and right arrow keys to move between the numbers. Press the OK key when the Time is correctly set.
OK		To set the date, select the date option and press OK
		Use the Up and Down arrow keys to change the numbers and the left and right arrow keys to move between the numbers. Press the OK key when the Time is correctly set.

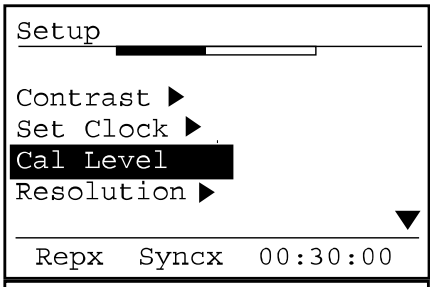
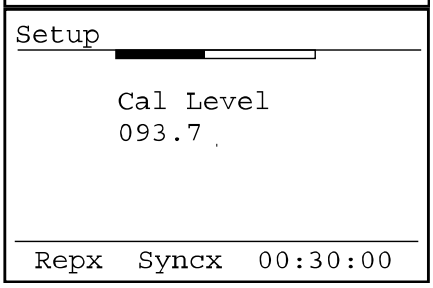
Calibration Level

The level at which the CR:800C instrument calibrates can be adjusted, if required, to suit different Acoustic Calibrators.

The default calibration level is 93.7dB for use with Cirrus Research plc CR:515 or CR:514 Series Acoustic Calibrators set to the 94dB setting. The correction of –0.3dB is

required to suit the MK:224 and MK:216 Microphone capsules used by the CR:800C Series.

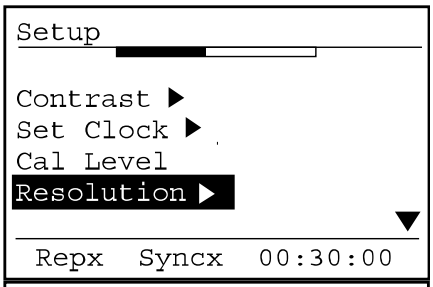
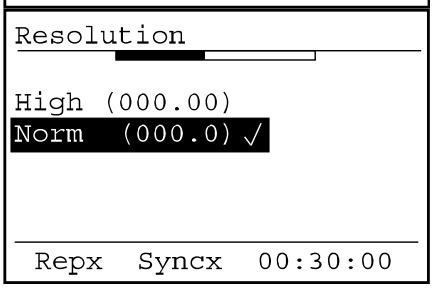
To adjust the calibration level, select the Cal Level option from the setup menu.

Key Press	Display	Comments
		
		Use the Up and Down arrows to adjust the level and the Left and Right arrow keys to move between the numbers. Press OK to accept the calibration level.

Cirrus Research plc does not recommend the use of Acoustic Calibrators other than those manufactured or supplied by Cirrus Research plc for use with the CR:800C instruments.

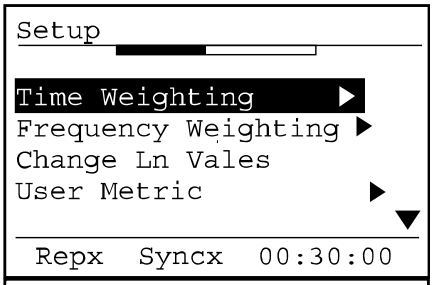
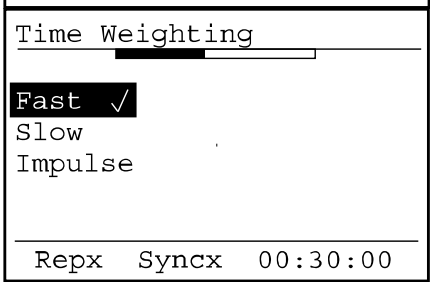
Display Resolution

The display resolution of the CR:800C instruments can be set to be either 0.1dB or 0.01dB. For most applications, the 0.1dB resolution is suitable.

Key Press	Display	Comments
		
OK		Use the Up and Down arrows keys to select the display resolution and press OK to select the required display resolution. Press Exit to return to the main display.

Time Weighting

The Time Weighting of the instrument can be set to either Fast, Slow or Impulse. To set the Time Weighting, select the Time Weighting option from the menu:

Key Press	Display	Comments
		
OK		Select the required Time Weighting and press OK to select. The currently selected Time Weighting is indicated by a tick. Press Exit to return to the main display.

The Time Weighting applies to the following parameters:

Broadband Mode

L_{AF},L_{AS},L_{AI},L_{CF},L_{CS},L_{CI},L_{ZF},L_{ZS} or L_{ZI} (not stored)
L_{AFmax},L_{ASmax},L_{AImax},L_{CFmax},L_{CSmax},L_{CImax},L_{ZFmax},L_{ZSmax} or L_{ZImax}
L_{AFmin},L_{ASmin},L_{AImin},L_{CFmin},L_{CSmin},L_{CImin},L_{ZFmin},L_{ZSmin} or L_{ZImin}
$L_{0.1}$ to $L_{99.9}$ (five simultaneous user-selected values available)

The L_n's or Statistical parameters are calculated from Sound Level. Therefore, if the Time Weighting is set to Fast, the L_n's will be calculated from L_{AF}.

1:1 Octave Band Mode

Filtered L_{ZS},L_{ZF} or L_ZI (not stored)

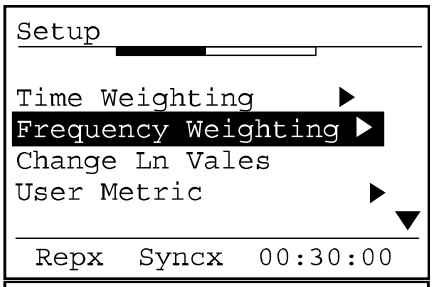
1:3 Octave Band Mode

Filtered L_{ZS},L_{ZF} or L_ZI (not stored)

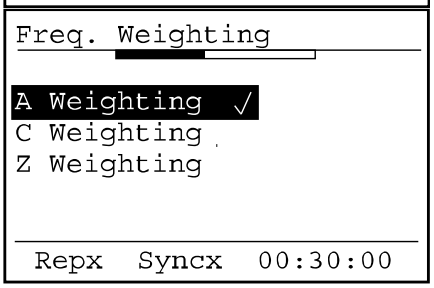
Frequency Weighting

The Frequency Weighting of the instrument can be set to either A, C or Z. To set the Frequency Weighting, select the required option from the menu:

Key Press	Display	Comments



OK



Select the required Frequency Weighting and press OK to select.

The select Frequency Weighting is indicated by a tick.

Press Exit to return to the main display.

The Frequency Weighting applies to the following parameters:

Broadband Mode

Integrated Sound Level	L_{Aeq},L_{Ceq}, or LZ_{eq}
Sound Level	L_{AF},L_{AS},L_{AI},L_{CF},L_{CS},L_{CI},L_{ZF},L_{ZS} or L_{ZI} (not stored)
Maximum Sound Leve	L_{AFmax},L_{ASmax},L_{AImax},L_{CFmax},L_{CSmax},L_{CImax},L_{ZFmax},L_{ZSmax} or L_{ZImax}
Minimum Sound Level	L_{AFmin},L_{ASmin},L_{AImin},L_{CFmin},L_{CSmin},L_{CImin},L_{ZFmin},L_{ZSmin} or L_{ZImin}
User Metric	L_{AE},L_{CE},or L_{ZE},L_{AIeq},L_{CIeq}, or L_{ZIeq}, L_{AFTeq}

1:1 Octave Band Mode

No measurements are affected by the Frequency Weighting. All 1:1 Octave Bands are measured with the Z Frequency Weighting.

1:3 Octave Band Mode

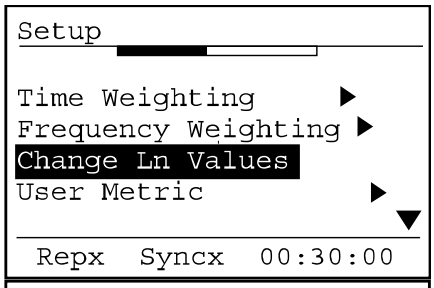
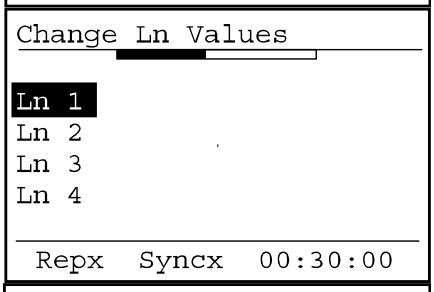
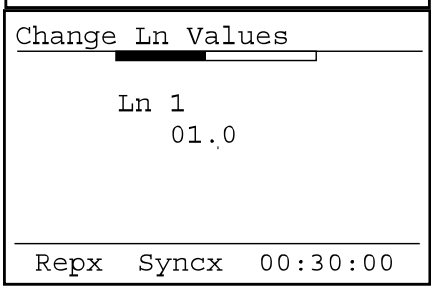
No measurements are affected by the Frequency Weighting. All 1:3 Octave Bands are measured with the Z Frequency Weighting.

Ln values

The five preset Ln or Statistical values that are calculated at the end of a Broadband measurement can be configured to different values.

The default values are $L_{1.0}$, $L_{10.0}$, $L_{50.0}$, $L_{90.0}$ and $L_{95.0}$

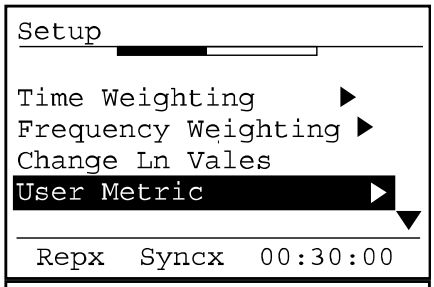
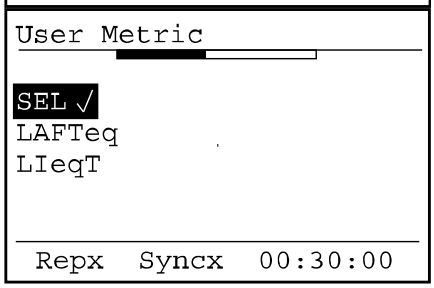
To change the Ln values, select Change Ln Values from the Setup Menu.

Key Press	Display	Comments
		
OK		The Ln to be changed can be selected using the Up and Down arrow keys. Press OK to select the Ln to change.
OK		In this example, the Ln1 has been selected. Use the Up and Down arrow keys to change the value and the Left and Right arrow keys to move between the numbers. Press OK to accept the changes or Exit to discard any changes.

The other Ln values can be altered in the same manner as shown above.

User Metric

The additional measurement parameter provided the CR:800C instrument is known as the User Metric. This measurement parameter can be selected to be either L_E (Sound Exposure Level, SEL), $L_{Ieq,t}$ (Impulse Weighted Time Weighted Sound Level) or L_{AFTeq} (Takt Maximal Sound Level).

Key Press	Display	Comments
		
OK		Select the required User Metric and press OK to select. The select User Metric is indicated by a tick. Press Exit to return to the main display.

Note that if the LIeq,t function is selected, the CR:800C will automatically select the Impulse Time Weighting which will apply to all other measurement functions described.

Before the Time Weighting can be selected to either Fast or Slow, the User Metric must be set to SEL.

Configuring the instrument from the Deaf Defier3 software

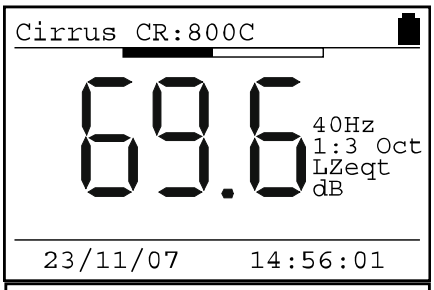
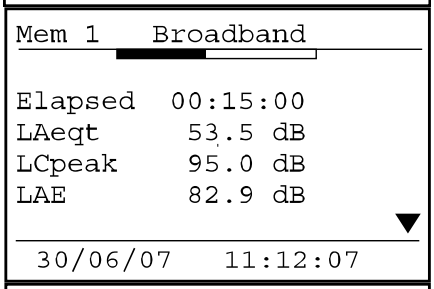
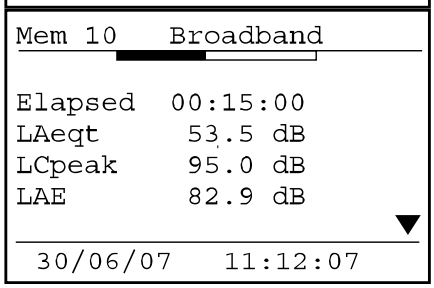
The entire configuration of the instrument can also be set from the Deaf Defier3 software using the Advanced Configuration option.

5 Viewing and Downloading the measurements

When a measurement stops, either by the user pressing the Stop key or when a measurement stops automatically, the data is automatically stored in the memory.

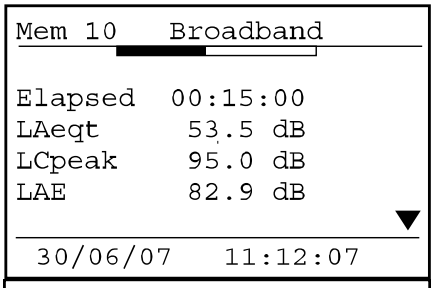
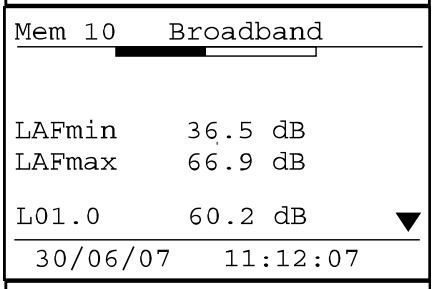
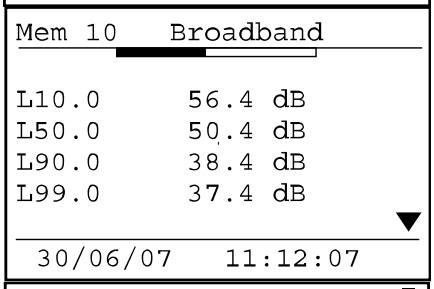
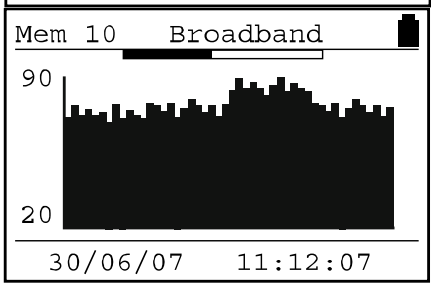
5.1 Recalling Stored Measurements

To view stored measurements, ensure that the instrument is not running. Press the right hand arrow key to view the first stored measurement and the left hand arrow key to view the last measurement stored.

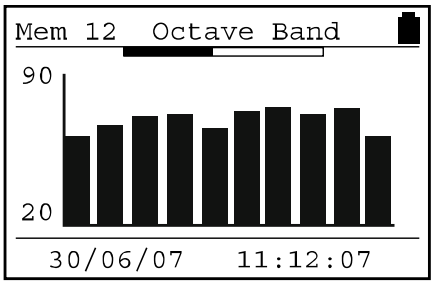
Key Press	Display	Comments
		
		The first measurement stored is shown. The parameters displayed depend upon the measurement type.
		The last measurement stored is shown. The parameters displayed depend upon the measurement type.

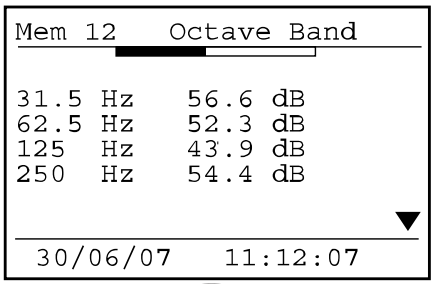
The measurement type is shown at the top of the screen next to the measurement number. The different measurement types have different parameters that are displayed and these are described below

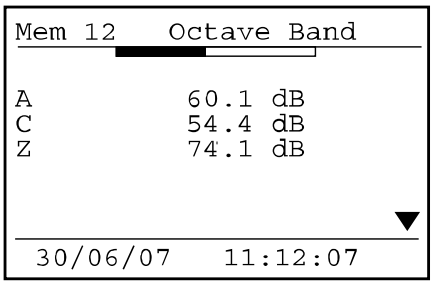
Broadband Measurement

Key Press	Display	Comments
		The User Metric setting of the instrument determines if the unit stores LAE, LAIeq,t or LAFTeq. If the unit was in Overload or Under-Range during the measurement this is indicated on the screen.
Display		
Display		
Display		The whole measurement duration is displayed on the screen when the Time History data is reviewed.

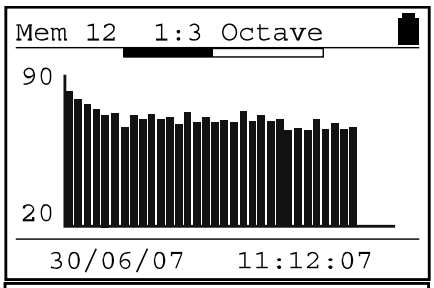
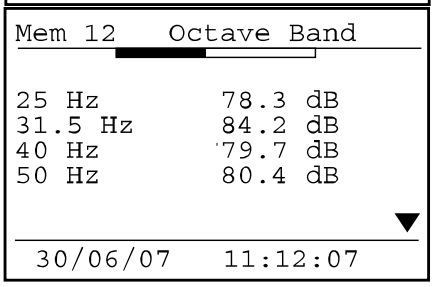
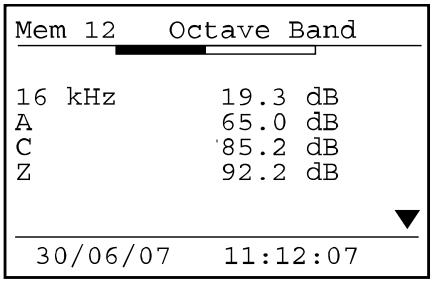
1:1 Octave Band Measurements

Key Press	Display	Comments
		The graphical display of the 1:1 Octave Band measurement is shown with the measurement range shown on the left hand scale.



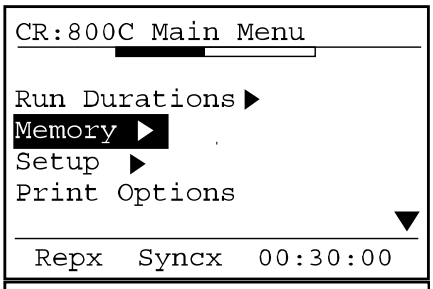
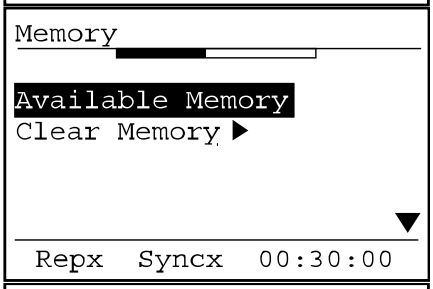
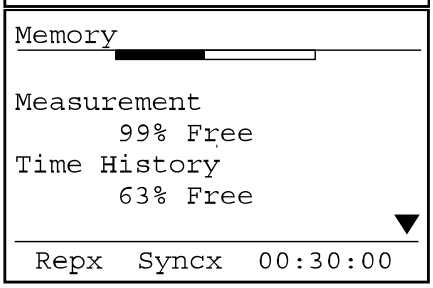


1:3 Octave Band Measurements

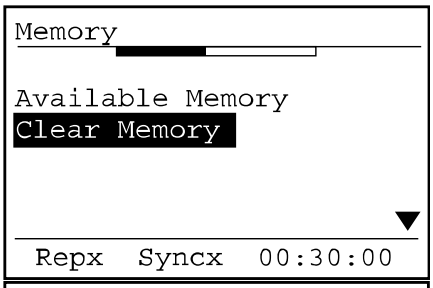
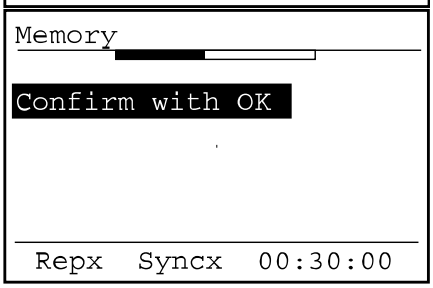
Key Press	Display	Comments
		The graphical display of the 1:3 Octave Band measurement is shown with the measurement range shown on the left hand scale.
		
		

5.2 Checking & Clearing the memory

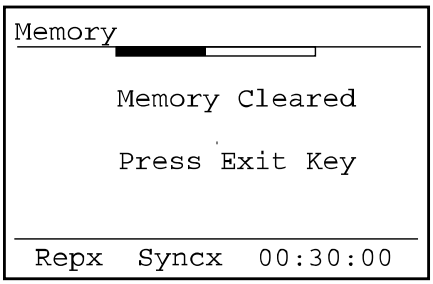
The memory of the instrument can be checked for available space and also to allow the user to delete the measurements that are stored. To check the available memory, select the Memory option from the menu:

Key Press	Display	Comments
Menu		
OK		
OK		This screen shows the amount of memory free for the main measurement store and the time history store.

To clear all the measurements from the memory, use the Clear Memory option:

Key Press	Display	Comments
OK		
OK		

OK



Exit

Please note that when the memory has been cleared, any measurement previously stored cannot be retrieved and are permanently deleted.

5.3 Downloading Measurements to the Software

Before measurements can be downloaded, the software must be installed on to a suitable PC.

5.4 Software Installation

The CR:800C Series are supplied with the Deaf Defier3 software on a CD-ROM.

Deaf Defier3 is suitable for PC's running Microsoft Windows 95 or later, including WindowsXP and Windows2000.

Deaf Defier3 is supplied on CD-ROM, with a full installation program, and comprehensive on line help, which gives details of the options and functions of the software, along with details of the calculations used in the Hearing Protector Selection Report.

Please also note that full administrator access may be required to install the Deaf Defier3 software under WindowsXP, Windows2000 or WindowsNT. Contact your system adminstrator for further details.

To install the software, insert the CD-ROM into a CD-ROM drive on the PC. The installation program should automatically start.

If the installation program does not automatically start run D:\setup.exe where D is the drive letter of the CD-ROM drive on the PC.

5.5 System Requirements

The Deaf Defier3 for Windows requires the following:

Microsoft Windows95, Windows 98, Windows 98 Second Edition, Windows ME, Windows NT Workstation 4.0 with service pack 6, Windows 2000 Professional with service pack 2, Windows XP Home Edition or Professional
Internet access for downloading software updates
6Mb of available hard disk space for program files
64Mb RAM (128Mb recommended)
CD-ROM Drive for Installation
VGA or higher resolution monitor, Super VGA Recommended
Microsoft compatible mouse or pointing device
USB Connection

5.6 Installation Requirements

Cirrus Research plc accepts no responsibility for the installation of the Deaf Defier3 software where the system requirements are not fully met and where the user does not have the correct configuration or access rights to enable the software to install correctly.

Microsoft® is a registered trademark of the Microsoft Corporation. Windows 95™, Windows98 ™, Windows ME ™ and Windows XP ™ are registered trademarks of the Microsoft Corporation.

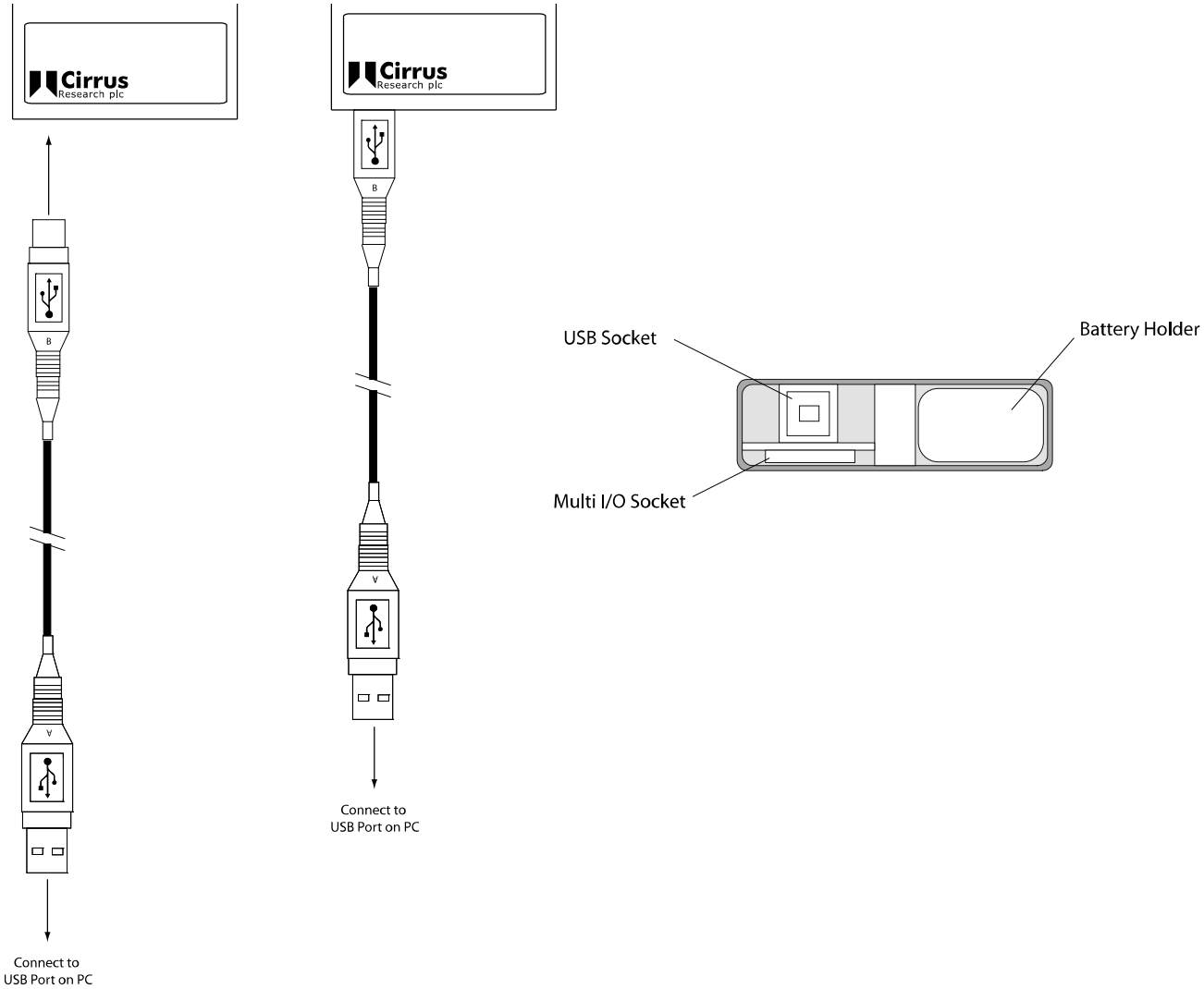
5.7 Connecting the instrument to the PC

The CR:800C instruments connect to the PC using the supplied ZL:100 USB Cable. Connect the ZL:100 USB Cable to the USB socket on the bottom of the instrument.

Ensure that the cable is inserted correctly with the arrow on the top of the connector.

Do not force the connector into the socket as this may cause damage.

When the Deaf Defier3 software is installed and run, use the Download option to connect to the instrument. Please refer to the Help provided with the Deaf Defier3 software for details of the download procedure.



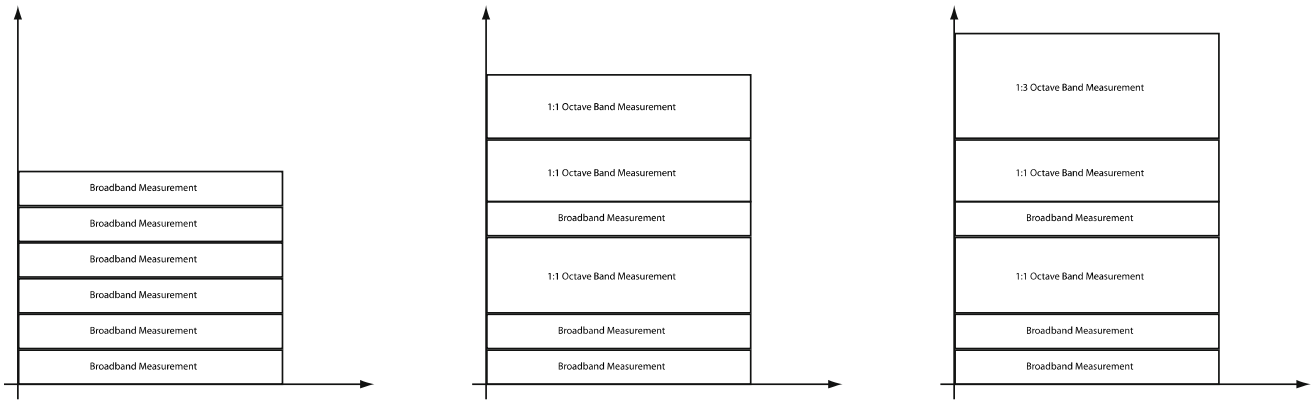
5.8 Understanding how the measurements are stored

The memory of the CR:800C can store up to 1,300 measurements. Each measurement is known as an Event and can be either Broadband, 1:1 Octave Band or 1:3 Octave Band.

The duration of each measurement does not affect the size that it takes, but the different measurements types take up different amounts of space in the instrument memory.

For example, a Broadband measurement take 1 memory slot, a 1:1 Octave measurement takes 2 memory slots and a 1:3 Octave measurement takes 3 memory slots.

The diagram below shows how the different measurements take up different amounts of memory space.



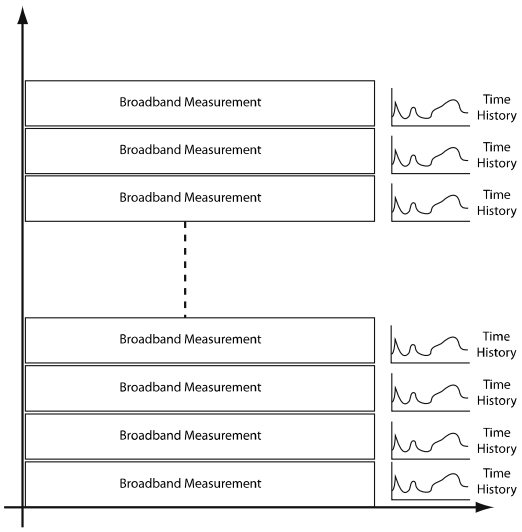
The maximum time over which Broadband measurements can be stored depends upon the duration of the measurement. The table below shows the maximum time over which measurements can be made. Please note that this applies only to Broadband Measurements using the Auto Repeat function.

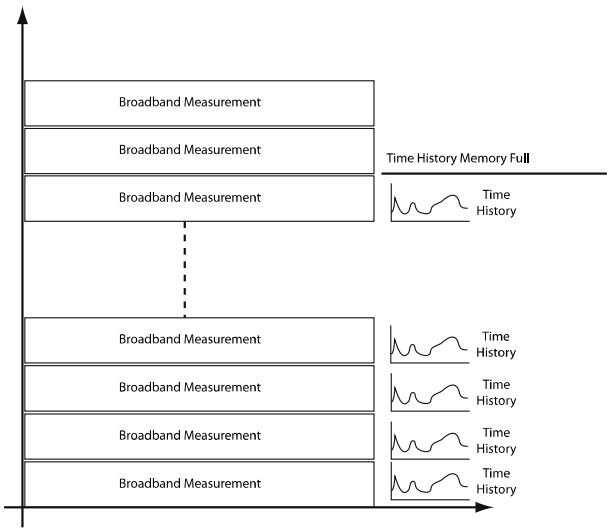
Measurement Duration	**Maximum Length of Measurement**
1 minute	21.5 hours
5 minutes	4.5 days
15 minutes	13.5 days
30 minutes	27 days
1 hour	54 days

With each Broadband Measurement is also stored a Time History measurement. This information is stored in a separate memory from the Events and does not take up any of the 1,300 Event memories. However, the Time History memory is limited to a size of 1,008,000 samples, with each sample being 1 second, which is just over 11 days of data storage.

If the Time History Store is full before the Event Memory Store, the Event measurements will continue but will not have Time History data.

The diagram below shows an example of this.


Broadband Measurement
Time History
Broadband Measurement
Time History
Broadband Measurement
Time History
Broadband Measurement
Time History
Broadband Measurement
Time History
Broadband Measurement
Time History


Broadband Measurement
Broadband Measurement
Time History Memory Full
Broadband Measurement
Time History
Broadband Measurement
Time History
Broadband Measurement
Time History
Broadband Measurement
Time History

6 Maintenance & Care

The CR:800C is a precision measurement instrument and should be treated with care. Do not allow the instrument to be exposed to substances which may cause damage to the components of the unit. If the instrument is to be used in an environment where particles such as dust may come into contact with the instrument, always use a Windshield (UA:237) to protect the microphone capsule.

The CR:800C is not waterproof and should not be used in situations where moisture will form or condense on the microphone capsule or the instrument body. If using the CR:800C outdoor, use a suitable outdoor measurement kit which has been specifically designed to protect the instrument.

If the CR:800C becomes dusty, wipe it down with a cloth that is lightly dampened with water or a mild detergent. Do not use aromatic hydrocarbons, chlorinated solvents, or methanol-based fluids when wiping down the meter.

Do not clean the microphone capsule. Do not remove the microphone grill as this can cause severe damage to the membrane. Physical damage to the microphone capsule is not covered by the instrument warranty.

If you experience any problems with the operation of the instrument, refer to page 53 for basic troubleshooting. If this does not solve the problem, contact Cirrus Research plc or your local representative for further assistance.

7 Troubleshooting

This section contains information which may solve simple operational problems you may encounter. If you are unable to solve the problem or experience any problems with the assembly or operation of the instrument contact Cirrus Research plc or your local representative for further assistance

7.1 Basics

Symptom	Possible Cause	Possible Remedy
The instrument does not switch on	The batteries are not fitted	Fit new batteries and switch on
	The batteries are flat or very low	Fit new batteries and switch on
	The batteries are not correctly fitted	Remove the batteries and check the polarity of the batteries

7.2 Calibration

Symptom	Possible Cause	Possible Remedy
The calibration fails: Too Low	The Acoustic Calibrator is not switched on	Switch on the Acoustic Calibrator and retry
	The Acoustic Calibrator is not fitted correctly	Check that the Acoustic Calibrator is fitted according to the instructions supplied.
	The Preamplifer is not fitted correctly. Class 1 Instruments only	For Class 1 Instruments, refer to page 15 for details of fitting the preamplifier.
	The microphone capsule is loose or not fitted	Check that the microphone capsule is tight and fitted correctly
	Calibration level set to a different level	Set the calibration level to the value provided by the Acoustic Calibrator. See page 37
	The Microphone may be damaged	Contact Cirrus Research plc or your local representative for assistance
The calibration fails: Too High	The Acoustic Calibrator is set to a higher level than the expected level	Set the Acoustic Calibrator to the correct level
The calibration fails: Unstable	The background noise level is within 15dB of the calibration level	Move to a location where the background noise level is more than 15dB below the calibration level
	The Microphone may be damaged	Contact Cirrus Research plc or your local representative for assistance

7.3 Measurements & Settings

Symptom	Possible Cause	Possible Remedy
No measurements have been stored	Memory is full.	Check the available memory. See page 45
	The measurement was reset	Restart the measurement
In 1:1 or 1:3 Octave Band Mode, the filters do not automatically sweep	The Run Duration has been set to Manual.	Select a Preset Run Duration
The measurements are not aligned with the clock	The Auto-Synchronise function is switched off	Switch on the Auto-Synchronise function
Instrument has selected Impulse Time weighting	L_{Ieqt} User Metric may have been selected	Select SEL User Metric and change Time Weighting required
Overload symbol is shown	The noise level is too high for the current range	Select a higher measurement range
Under Range symbol is shown	The noise level is too low for the current range	Select a lower measurement range.
The measurement stops after a set time	The Run Duration has been set to a preset value.	Select the Manual Run Duration
	The Run Duration has been set to the User Defined value.	Select the Manual Run Duration
The measurement does not stop as expected	The Run Duration has been set to Manual	Select a preset Run Duration

7.4 Downloading Measurements

Symptom	Possible Cause	Possible Remedy
Measurements cannot be downloaded	No measurements have been stored	Repeat Measurement
	Instrument is not connected to PC	Connect the USB Cable and retry.
	Batteries are too low	Replace batteries

8 Glossary

1:1 Octave Band Filters	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
1:3 Octave Band Filters	Single 1:1 Octave bands divided into three parts.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
Acoustic Calibrator	An instrument that provides a reference noise source that is used to calibrate and check the performance of a Sound Level Meter.
Broadband	Noise Measurements using parameters which include all the audible noise, such as dB(A) and dB(C)
C Weighting	A standard weighting of the audible frequencies used for the measurement of Peak Sound Pressure level.
CE Marking	A label used to show that the Sound Level Meter conforms to the specification of a European Directive
dB(A)	Decibels A weighted
dB(C)	Decibels C Weighted
dB(Z)	Decibels Z weighted
Decibel (dB)	The units of sound level and noise exposure measurement
DIN 45641	German Standard which defines the additional measurements L_{AFTeq} & L_{IeqT}
Fast Time Weighting	A standard time weighting applied by the Sound Level Meter
IEC 60651:1979	The International Standard for Sound Level Meters
IEC 60804:1984	The International Standard for Integrating & Integrating-Averaging Sound Level Meters
IEC 61260:1995	The International Standard for 1:1 Octave & 1:3 Octave Band Filters
IEC 61672-1:2003	The International standard for Sound Level Meter and Integrating Averaging Sound Level Meters that replaces both IEC 60651 and IEC 60804
Impulse Time Weighting	A standard time weighting applied by the Sound Level Meter
Integrating Averaging Sound Level Meter	A Sound Level Meter which accumulates the total sound energy over a measurement period and calculates an average
$L_{A10.0}$	The noise level exceeded for 10% of the measurement period with 'A' frequency weighting calculated by statistical analysis
$L_{A90.0}$	The noise level exceeded for 90% of the measurement period with 'A' frequency weighting calculated by statistical analysis
L_{AE}	Sound Exposure Level (SEL) with 'A' frequency weighting
$L_{Aeq,t}$	Equivalent continuous sound pressure level. A measure of the average sound pressure level during a period of time, t, in dB with 'A' weighting.
L_{AF}	Sound level with 'A' Frequency weighting and Fast Time weighting
L_{AFmax}	The maximum Sound level with 'A' Frequency weighting and Fast Time weighting
L_{AFmin}	The minimum Sound level with 'A' Frequency weighting and Fast Time weighting
L_{AFTeq}	Takt maximal sound level as defined by DIN 45641
L_{AI}	Sound level with 'A' Frequency weighting and Impulse Time weighting
L_{AImax}	The maximum Sound level with 'A' Frequency weighting and

	Impulse Time weighting
L_{AImin}	The minimum Sound level with 'A' Frequency weighting and Impulse Time weighting
L_{AS}	Sound level with 'A' Frequency weighting and Slow Time weighting
L_{ASmax}	The maximum Sound level with 'A' Frequency weighting and Slow Time weighting
L_{ASmin}	The minimum Sound level with 'A' Frequency weighting and Slow Time weighting
L_{CE}	Sound Exposure Level (SEL) with 'C' frequency weighting
$L_{ceq,t}$	Equivalent continuous sound pressure level. A measure of the average sound pressure level during a period of time, t, in dB with 'C' weighting.
L_{CF}	Sound level with 'C' Frequency weighting and Fast Time weighting
L_{CFmax}	The maximum Sound level with 'C' Frequency weighting and Fast Time weighting
L_{CI}	Sound level with 'C' Frequency weighting and Impulse Time weighting
L_{CImax}	The maximum Sound level with 'C' Frequency weighting and Impulse Time weighting
L_{Cpeak}	Peak Sound pressure level with 'C' frequency weighting
L_{CS}	Sound level with 'C' Frequency weighting and Slow Time weighting
L_{CSmax}	The maximum Sound level with 'C' Frequency weighting and Slow Time weighting
$L_{EP,d}$	Daily personal noise exposure
L_{eq}	Equivalent continuous sound pressure level. A measure of the average sound pressure level during a period of time, t, in dB
L_{IeqT}	Impulse weighted $L_{eq,t}$ as defined by DIN 45641
L_{n}	Statistical analysis of noise levels. The n denotes the percentage exceedence.
L_{ZE}	Sound Exposure Level (SEL) with 'Z' frequency weighting
$L_{Zeq,t}$	Equivalent continuous sound pressure level. A measure of the average sound pressure level during a period of time, t, in dB with 'Z' weighting.
L_{ZF}	Sound level with 'Z' Frequency weighting and Fast Time weighting
L_{ZFmax}	The maximum Sound level with 'Z' Frequency weighting and Fast Time weighting
L_{ZI}	Sound level with 'Z' Frequency weighting and Impulse Time weighting
L_{ZImax}	The maximum Sound level with 'Z' Frequency weighting and Impulse Time weighting
L_{ZS}	Sound level with 'Z' Frequency weighting and Slow Time weighting
L_{ZSmax}	The maximum Sound level with 'Z' Frequency weighting and Slow Time weighting
Overload	The input to the Sound Level Meter is too high for the current measurement range. Change the range
Peak	The maximum value reached by the sound pressure at any instant during a measurement period (in dB usually with C frequency weighting)
SEL	Sound Exposure Level, displayed as L_{AE}, L_{CE} or L_{ZE}
Slow Time Weighting	A standard time weighting applied by the Sound Level Meter

Sound Level	Sound Pressure Level with a Frequency weighting, such as dB(A)
Sound Level Meter	An instrument for measuring various noise parameters
SPL	Sound Pressure Level, the basic measure of noise loudness, expressed in decibels
Statistical Analysis	A calculation performed by a Sound Level Meter on the noise levels measured during the measurement period to describe the statistical spread of the noise.
Time History	A sample of the noise levels taken every 1 second throughout the measurement period.
Class 1	Laboratory & Field Grade for Sound Level Meters
Class 2	General Field Grade for Sound Level Meter
Under Range	The input to the Sound Level Meter is too low for the current measurement range. Change the range
Z Weighting	Z weighting is a flat frequency response of 8Hz – 20kHz ±1,5dB excluding microphone response.

9 Appendix 1 Specifications

9.1 Instrument Versions

CR:811C	Class 1
CR:812C	Class 2
CR:821C	Class 1 with 1:1 Octave Band Filters
CR:822C	Class 2 with 1:1 Octave Band Filters
CR:831C	Class 1 with 1:1 & 1:3 Octave Band Filters
CR:832C	Class 2 with 1:1 & 1:3 Octave Band Filters

9.2 Applicable Standards

Sound Level Meter

IEC 61672-1:2002 Class 1 or 2 Group X
IEC 60651:1979 Class 1 I or Class 2 I
IEC 60804:1985 Class 1 or Class 2
ANSI S1.4 with NK:70 Random Incidence Adaptor Fitted

1:1 & 1:3 Octave Band Filters (where fitted)

IEC 61260 Class 1

9.3 Microphone

Class 1	MK:224 pre-polarized Free-field ½" Condenser
Class 2	MK:216 pre-polarized Free-field ½" Condenser Random Incidence to ANSI S1.4 with NK:70 Adaptor
Capacitance	18pF

9.4 Microphone Preamplifier

Class 1	MV:200D Removable Preamplifier
Class 2	MV:200D Integral Preamplifier

9.5 Extension cables

ZL:202 2m
ZL:205 5m
ZL:210 10m
ZL:215 15m
ZL:220 20m
ZL:225 25m

9.6 Time Weightings

‘F‘ (Fast)	to IEC 61672-1:2002 Class 1 or 2 Group X
‘S' (Slow)	to IEC 61672-1:2002 Class 1 or 2 Group X
‘I' (Impulse)	to IEC 61672-1:2002 Class 1 or 2 Group X

9.7 Frequency Weightings

Channel 1	‘A', ‘C' or ‘Z'
Channel 2	‘C' for Peak

Z weighting is a flat frequency response of 8Hz – 20kHz ±1.5dB excluding microphone response. When either 1:1 or 1:3 Octave Band filters are selected the ‘Z' weighting is used.

9.8 Amplitude Weighting

Q=3 (True Energy Integration)

9.9 Measurement Range

Broadband

21dB(A) to 140dB(A) Class 1
25dB(A) to 140dB(A) Class 2
143dB(C) Peak (70 to 140dB Range)

1:1 Octave Band Filters

19dB(Z) to 140dB(Z)

1:3 Octave Band Filters

14dB(Z) to 140dB(Z)

Range Steps

10-80, 20-90, 30-100, 40-110, 50-120, 60-130, 70-140

9.10 Noise Floor (Typical)

Broadband

18dB(A) Class 1, 20dB(A) Class 2

1:1 Octave Band Filters

12dB(Z) @ 1kHz 1:1 Octave Band

1:3 Octave Band Filters

7dB(Z) @ 1kHz 1:3 Octave Band

9.11 Available Measurements

The following metrics can be displayed for a recorded session and stored:

Broadband Mode

L_{CPeak}
L_{AF},L_{AS},L_{AI},L_{CF},L_{CS},L_{CI},L_{ZF},L_{ZS} or L_{ZI} (not stored)
L_{AFmax},L_{ASmax},L_{AImax},L_{CFmax},L_{CSmax},L_{CImax},L_{ZFmax},L_{ZSmax} or L_{ZImax}
L_{AFmin},L_{ASmin},L_{AImin},L_{CFmin},L_{CSmin},L_{CImin},L_{ZFmin},L_{ZSmin} or L_{ZImin}
L_{Aeq},L_{Ceq}, or LZ_{eq}
L_{AE},L_{CE},or L_{ZE},L_{AIeq},L_{CIeq}, or L_{ZIeq}, L_{AFTeq}
$L_{0.1}$ to $L_{99.9}$ (five simultaneous user-selected values available)
Run time
Date and time
1 second Short L_{eq} Noise Profile

The Ln data is calculated from the Sound Level data and is Time Weighted according to the selected Time Weighting.

Filter mode

1:1 or 1:3 filter selected
Selected frequency
Filtered L_{ZS},L_{ZF} or $L_{Z}I$ (not stored)
Filtered L_{Zeq} (stored)
L_{Aeq}, L_{Ceq}, L_{Zeq} (stored)
Run time
Date and time

9.12 Frequency Bands (Nominal Frequencies)

1:1 Octave Band

31Hz, 63Hz, 125Hz, 250Hz, 500Hz, 1kHz, 2kHz, 4kHz, 8kHz, 16kHz

1:3 Octave Band

25Hz to 16kHz
20Hz & 20kHz with MO:800/6 Factory Option

9.13 Memory

16Mbit memory allowing up to:
1300 broadband measurements
770 1:1 octave measurements
330 1:3 octave measurements

For example, broadband mode allows 12 days of 15 minute measurements to be stored. Calibration records are automatically stored in the instrument memory.

Noise Profile

Short Leq (L_{Aeq},L_{Ceq}, or L_{Zeq}).
Up to 11 days at 1 second acquisition

9.14 Automatic Measurements

The unit can be set to record and store data over fixed times of

1 minute	5 minutes
10 minutes	15 minutes
30 minutes	1 hour
8 hours	12 hours

or a user defined period
Automatic Repeat From 2 to 999 measurements (broadband mode only)
Auto-synchronise to the clock.

9.15 Display

Matrix LCD with backlight & Quasi Analogue Bar Graph
Selected measurement parameter with level
Warnings for Overload, Under Range and
Low Battery
Time & Frequency Weighting
Elapsed measurement time
Real time short Leq (broadband mode)
Graphical 1:1 and 1:3 Octave Band (recall mode only)
Recalled stored measurements
Measurement Range

9.16 Weight

450 gms

9.17 Dimensions

340mm x 75mm x 25mm

9.18 Batteries

2 x 1.5v Alkaline LR6/AA

9.19 Battery Life

Broadband	Typically >30 hours
Filter Mode	Typically >20 hours

Battery voltage is continuously monitored and warning is given on display of impending low battery condition. When batteries approach end of life the unit will store any data required and switch off automatically.

9.20 Environmental

Temperature

Operating	-10°C to +50°C
Storage	-20°C to +60°C

Humidity

Up to 95% RH Non Condensing

9.21 External Connections

Data Output	USB Type B Socket
	Multi-pin Expansion Socket

9.22 Output Cables

Standard	ZL:100 USB Cable (supplied as standard)
Optional	ZL:811 Power Adaptor Cable for CU:195A Power Supply
	ZL:812 AC Output Cable to Phono Plug
	ZL:813 RS232 Output
	ZL:814 Multi-IO Interface Cable

9.23 Software Support

Deaf Defier3 for Windows

System Requirements

The Deaf Defier3 for Windows requires the following:
Microsoft Windows 95 or later
6Mb of available hard-disk space for program files
CD-ROM Drive
VGA or higher resolution monitor, Super VGA Recommended
Microsoft compatible mouse or pointing device

9.24 Factory Options

MO:800/1	Upgrade from Class 2 to Class 1
MO:800/2	Upgrade from Broadband to 1:1 Octave Band Filters
MO:800/3	Upgrade from Broadband to 1:1 & 1:3 Octave Band Filters
MO:800/4	Upgrade from 1:1 to 1:1 & 1:3 Octave Band Filters
MO:800/5	Remote Preamplifier for Class 2 Instruments
MO:800/6	20Hz & 20kHz 1:3 Octave Band Filters

Electromagnetic Performance

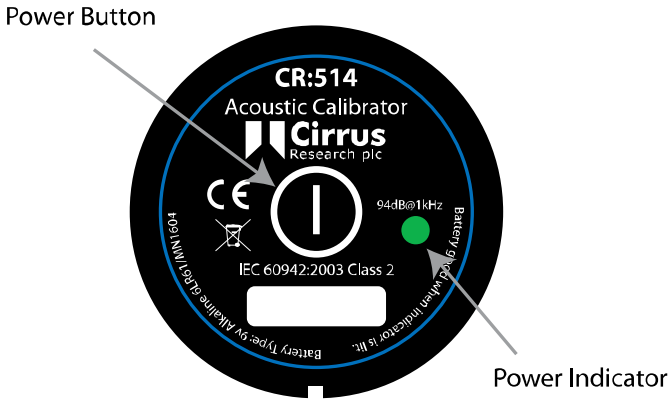
EN 61000-6-3: 2007
EN 61000-6-1:2007

10 Appendix 2 Acoustic Calibrators

10.1 Operation.

Switching on the Calibrator

Press the Power Button on the end of the Calibrator to switch the unit on. The Indicator will illuminate to show that the unit is operating.



The calibrator will automatically switch off after 5 minutes to preserve battery power.

To switch off the calibrator manually, press the power button again and the indicator will extinguish to show that the unit is switched off.

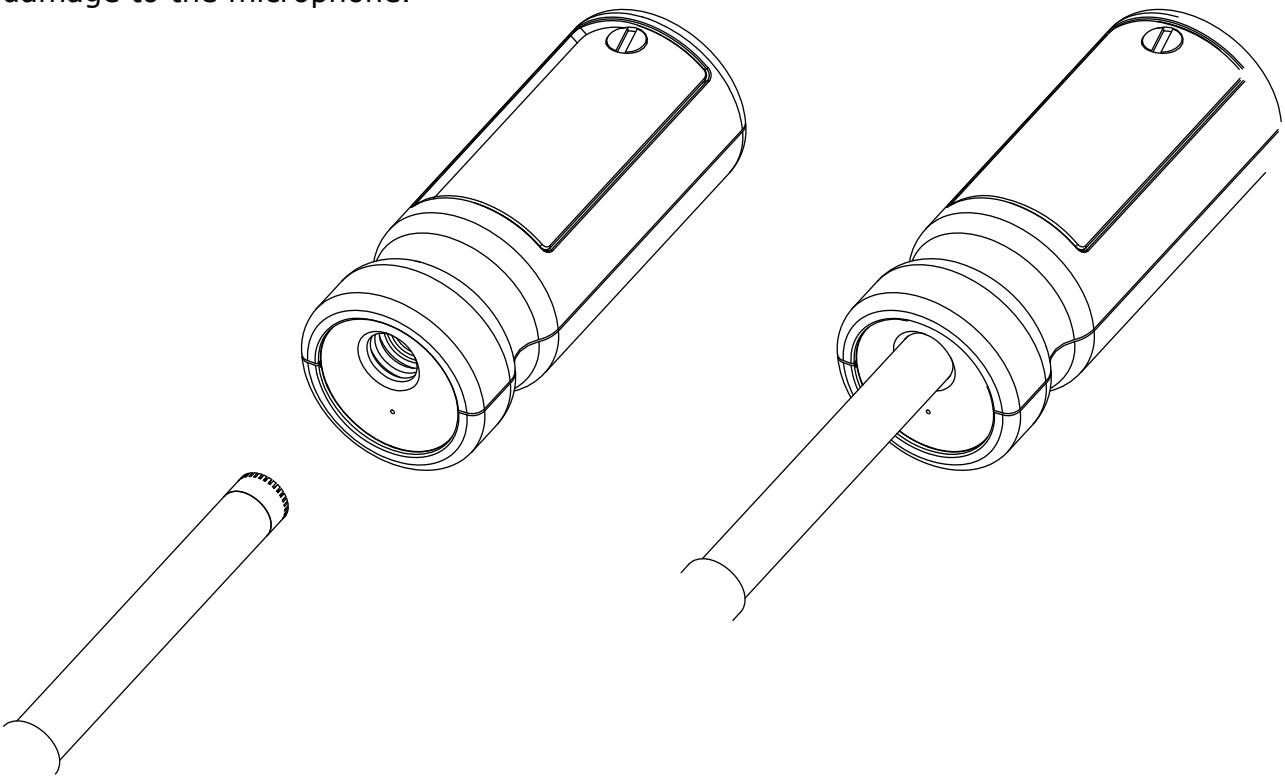
Permanent-on Mode

For some applications there may be a need to have the calibrator switched on continuously. To allow for this, the calibrator can be turned on by pressing and holding the power button for three seconds.

Release the button and the indicator will flash to show that the unit is in permanent-on mode. Press the power button to switch off the calibrator.

Calibrating a Sound Level Meter.

Push the microphone of the Sound Level Meter into the cavity at the end of the calibrator. Ensure the microphone is fully inserted into the cavity and is past the 'O' ring seals. The microphone should be parallel to the body of the calibrator. Also ensure that the small bleed-hole next to the microphone cavity is not blocked as this could cause damage to the microphone.



Most modern Sound Level Meters have electronic calibration with the level adjusted automatically. Adjust the Sound Level Meter to the correct level where applicable. When correcting the value generated by the calibrator a correction for the type of microphone capsule may need to be applied (see Appendix 2)

Background Noise

In order for the calibrator to operate as intended, the ambient acoustic noise level should be no greater than 80dBA.

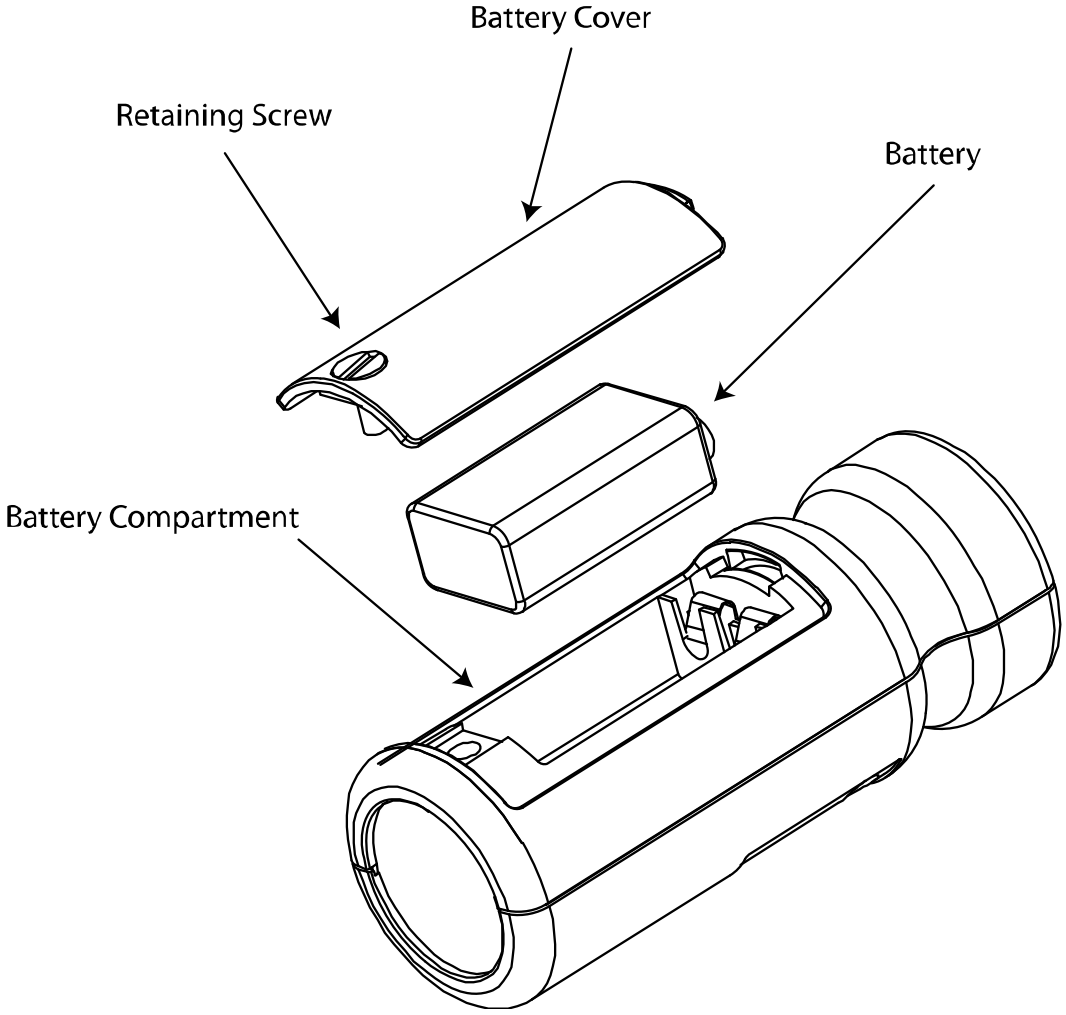
Stabilisation

In order for the sound pressure level and frequency to stabilise after switching the calibrator on when coupled to a microphone, a period of at least 3 seconds should be allowed before performing a calibration.

10.2 Changing the Battery

The CR:514 & CR:515 acoustic calibrators use a single 9v alkaline battery. This type of battery is known as 6F22 or NEDA 1604. It is also commonly known as PP3.

1. Unscrew the screw holding the battery cover on, using a coin.
2. The battery, type 6F22 (PP3) can now be eased out of its holder and replaced. The battery should be eased out terminal side first by pushing against the spring at the other end. Ensure that the battery is inserted with the correct polarity with the negative terminal at the contact with the larger cutout.



Battery type.

The battery should be an alkaline battery, not an ordinary dry cell. The battery is 9 volts when new and will operate the calibrator down to 6.4 volts. When the battery voltage is below 6.6 volts but above 6.4 volts, the power LED will flash to indicate that the battery voltage is low. When the battery voltage is below 6.4 volts the calibrator will not turn on. A discharged battery may allow switch-on but will soon drop in voltage and indicate low battery or switch off.

10.3 Specification.

Frequency	1kHz ± 1%
Sound Level	94dB re 20µPa
Standardisation	CR:514 - IEC 60942:2003 Class 2 CR:515 - IEC 60942:2003 Class 1
Distortion	Less than 2%
Operating Humidity	25 to 90% Relative Humidity
Operating Static Pressure	65 kPa to 108kPa
Operating Temperature	-10°C to +50°C
Storing Temperature	-20°C to +60°C
Effective Volume	6.19 $cm^3 \pm 0.2$ cm^3
Cavity Diameter	0.525 inch
Battery	1 x 9v 6F22 (Neda 1604)
Battery Life	Approx 15 Hours Continuous Use
Battery Voltage	9v Nominal (10v Maximum, 6.4v Minimum)
Weight with Battery	185g
Dimensions	135mm x Ø48mm

10.4 Technical Information

The normal mode of operation of the calibrator is with the unit switched on.

When the LED indicates the unit is switched on this produces the greatest radio frequency emissions.

The calibrator continues to function after exposure to contact discharges up to 4kV and air discharges up to 8kV, for both positive and negative voltages relative to earth ground.

The calibrator conforms to IEC 60942:2003 for a modulated root-mean-square electromagnetic field strength of 10 V/m.

The maximum susceptibility to power and radio frequency fields is with the cavity facing away from the emitter with the battery compartment facing the table, the antenna polarisation horizontal and the calibrator switched on.

10.5 Free Field Correction

When calibrating a microphone which is to be used for free field measurements, a small correction may be necessary to compensate for the difference between the microphone's free field response at 'zero degrees' or 'head-on' incidence and the pressure level generated by the calibrator.

The correction is typically -0.3dB for ½ inch microphones (making the effective calibration level 93.7dB).

The table below shows the correction values for the standard microphones of Cirrus Research plc.

Calibration corrections are listed below for the Cirrus Research plc ½" Capsules and three microphone capsules commonly used in Calibration Laboratories:

Microphone Correction Values

Microphone Type	Calibration Correction	Effective Calibration Level
MK:202	**-0.3dB**	**93.7 dB**
MK:215	**-0.3dB**	**93.7 dB**
MK:216	**-0.3dB**	**93.7 dB**
MK:226	**-0.3dB**	**93.7 dB**
MK:224	**-0.3dB**	**93.7 dB**
B&K 4134	0dB	94.0 dB
B&K 4180	0dB	94.0 dB
B&K 4192	0dB	94.0 dB

Example

An example of the procedure used to calculate the value for an MK:224 microphone is shown below :

Level = 94.0dB + Microphone Correction

Level = 94.0dB + (-0.3dB)

Level = 93.7dB

Different microphones will have different correction values. Please check the operation manual for the Sound Level Meter or microphone concerned for details.

11 Appendix 3 CE Certificate of Conformity

Cirrus Research plc
dedicated to noise measurement

We, the undersigned,

Manufacturer's name:	Cirrus Research plc
Manufacturer's address:	Bridlington Road, Hunmanby,YO14 0PH, North Yorkshire, UK.

Certify and declare that the following apparatus:

Product description:	Sound Level Meters
Product name:	CR:800C Series
Product Number:	CR:812C, CR:811C, CR:822C, CR:821C, CR:832C, CR:831C
Product description:	Acoustic Calibrators
Product name:	CR:510 Series
Product Number:	CR:515, CR:514

conforms with the essential requirements of the following Directives:

EU EMC Directive (Dec 2004) 2004/108/EU

Applied Harmonised standards (where appropriate)
EN 61000-6-3:2007
EN 61000-6-1:2007

Except where modified by
IEC 61672-1:2002
IEC 61672-2:2003
IEC 61942:2003

Signed for and on behalf of Cirrus Research plc
Date: 10th January 2008

Mr S.T.O'Rourke
Engineering Director

12 Warranty Information.

1. This document is a summary of the full warranty document and explains the Cirrus Research plc warranty in ordinary English; not in legal or complex terms.

2. The warranty covers any acoustic instrument such as a sound level meter, acoustic calibrator, real time acoustic analyser or personal sound exposure meter (dosemeter) manufactured by Cirrus Research plc after March 1st 2007.

3. The warranty covers all faults on the instrument except the microphone and the display for the period defined in para (4) below, including minor accidental damage except to the microphone or display.

4. In common with almost all acoustic manufacturers, Cirrus Research plc do not give a warranty on the microphone or display – normally an LCD, because of their fragile nature.

5. The period of the warranty is 2 (two) years or 104 weeks from the date of purchase as a new instrument from Cirrus Research plc or their formally approved distributors OR 130 weeks from the date the instrument passed its final manufacturing inspection at Cirrus Research plc - whichever is the shorter.

6. Any rechargeable battery only has the battery manufacturer's one year warranty.

7. No warranty is offered for used equipment unless a special arrangement is made and a written confirmation of the warranty is given by Cirrus Research plc.

8. The warranty becomes void if the instrument is not returned for calibration within 18 months or 78 weeks of purchase. In the International Standard IEC 61672 this 'calibration' is described as "Routine Verification" and it is required to ensure that any acoustic instrument measures correctly.

9. On completion of the "Routine Verification" by Cirrus Research plc, the instrument will automatically be given an additional free one year warranty.

10. There will be a charge for this routine verification and the price is published in the Service Price List.

11. It follows that should the instrument be routinely verified by Cirrus Research plc every year, the warranty is effectively continuous to a maximum of 12 (twelve) years from the date of purchase.

12. Cirrus Research endeavour to ensure stocks of instrument components for the full twelve year period but do not guarantee to do so as certain components do become obsolete or discontinued.

13. If a sub-component becomes obsolete and stocks are depleted then Cirrus Research will endeavour to facilitate a repair but will not offer the same length guarantee.

14. In the event of any dispute on the terms of the warranty Cirrus Research plc will accept pendulum arbitration by the United Kingdom Institute of Acoustics Ltd.

15. The warranty does not in any way reduce any legal right of the buyer or user of the sound level meter; it is in addition to all legal rights determined by the European Union.

13 Cirrus Research Offices

The addresses given below are the Cirrus Research plc offices. Cirrus Research plc also have approved distributors and agents in many countries worldwide. For details of your local representative, please contact Cirrus Research plc at the address below. Contact details for Cirrus Research authorised distributors and agents are also available from the Internet Web site at the address shown below.

Main Office

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
United Kingdom
YO14 0PH

Telephone:	01723 891655
Fax:	01723 891742
e-mail:	sales@cirrusresearch.co.uk
Technical Support	support@cirrusresearch.co.uk
Web Site:	www.cirrusresearch.co.uk

Germany

Cirrus Research Buro Dresden
Karl-Marx-Str. 11a
D-01109 Dresden
Germany

Telephone:	(+49) 351 316 0950
Fax:	(+49) 351 316 0949
e-mail:	verteib@cirrusresearch.de
Website	www.cirrusresearch.de

France

Cirrus France Ltd
7 Rue Haute
11230 Caudeval
France

Telephone:	(+33) 468 692 091
Fax:	(+33) 468 692 091
Email:	sales@cirrusresearch.fr
Web:	www.cirrusresearch.fr